HOLOGRAPHIC ORDER

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Introduction

This book is a collection of essays (see Acknowledgments) representing the development of my thinking over the past twenty years. A brief introduction will perhaps be useful in order to indicate what are the principal questions that are to be discussed, and how they are connected.

I would say that in my scientific and philosophical work, my main concern has been with understanding the nature of reality in general and of consciousness in particular as a coherent whole, which is never static or complete, but which is in an unending process of movement and unfoldment. Thus, when I look back, I see that even as a child I was fascinated by the puzzle, indeed the mystery, of what is the nature of movement. Whenever one *thinks* of anything, it seems to be apprehended either as static, or as a series of static images. Yet, in the actual experience of movement, one *senses* an unbroken, undivided process of flow, to which the series of static images in thought is related as a series of 'still' photographs might be related to the actuality of a speeding car. This question was, of course, already raised in

essence philosophically more than 2,000 years ago in Zeno's paradoxes; but as yet, it cannot be said to have a satisfactory resolution.

Then there is the further question of what is the relationship of thinking to reality. As careful attention shows, thought itself is in an actual process of movement. That is to say, one can feel a sense of flow in the 'stream of consciousness' not dissimilar to the sense of flow in the movement of matter in general. May not thought itself thus be a part of reality as a whole? But then, what could it mean for one part of reality to 'know' another, and to what extent would this be possible? Does the content of thought merely give us abstract and simplified 'snapshots' of reality, or can it go further, somehow to grasp the very essence of the living movement that we sense in actual experience?

It is clear that in reflecting on and pondering the nature of movement, both in thought and in the object of thought, one comes inevitably to the question of wholeness or totality. The notion that the one who thinks (the Ego) is at least in principle completely separate from and independent of the reality that he thinks about is of course firmly embedded in our entire tradition. (This notion is clearly almost universally accepted in the West, but in the East there is a general tendency to deny it verbally and philosophically while at the same time such an approach pervades most of life and daily practice as much as it does in the West.) General experience of the sort described above, along with a great deal of modern scientific knowledge concerning the nature and function of the brain as the seat of thought, suggest very strongly that such a division cannot be maintained consistently. But this confronts us with a very difficult challenge: How are we to think coherently of a single, unbroken, flowing actuality of existence as a whole, containing both thought (consciousness) and external reality as we experience it?

Clearly, this brings us to consider our overall *world view*, which

includes our general notions concerning the nature of reality, along with those concerning the total order of the universe, i.e., *cosmology*. To meet the challenge before us our notions of cosmology and of the general nature of reality must have room in them to permit a consistent account of consciousness. Vice versa, our notions of consciousness must have room in them to understand what it means for its content to be 'reality as a whole'. The two sets of notions together should then be such as to allow for an understanding of how reality and consciousness are related.

These questions are, of course, enormous and could in any case probably never be resolved ultimately and completely. Nevertheless, it has always seemed important to me that there be a continuing investigation of proposals aimed at meeting the challenge that has been pointed out here. Of course, the prevailing tendency in modern science has been against such an enterprise, being directed instead mainly toward relatively detailed and concrete theoretical predictions, which show at least some promise of eventual pragmatic application. Some explanation of why I want to go so strongly against the prevailing general current seems therefore to be called for.

Aside from what I feel to be the intrinsic interest of questions that are so fundamental and deep, I would, in this connection, call attention to the general problem of fragmentation of human consciousness, which is discussed in chapter 1. It is proposed there that the widespread and pervasive distinctions between people (race, nation, family, profession, etc., etc.), which are now preventing mankind from working together for the common good, and indeed, even for survival, have one of the key factors of their origin in a kind of thought that treats *things* as inherently divided, disconnected, and 'broken up' into yet smaller constituent parts. Each part is considered to be essentially independent and self-existent.

When man thinks of himself in this way, he will inevitably tend to defend the needs of his own 'Ego' against those of the

others; or, if he identifies with a group of people of the same kind, he will defend this group in a similar way. He cannot seriously think of mankind as the basic reality, whose claims come first. Even if he does try to consider the needs of mankind he tends to regard humanity as separate from nature, and so on. What I am proposing here is that man's general way of thinking of the totality, i.e. his general world view, is crucial for overall order of the human mind itself. If he thinks of the totality as constituted of independent fragments, then that is how his mind will tend to operate, but if he can include everything coherently and harmoniously in an overall whole that is undivided, unbroken, and without a border (for every border is a division or break) then his mind will tend to move in a similar way, and from this will flow an orderly action within the whole.

Of course, as I have already indicated, our general world view is not the *only* factor that is important in this context. Attention must, indeed, be given to many other factors, such as emotions, physical activities, human relationships, social organizations, etc., but perhaps because we have at present no coherent world view, there is a widespread tendency to ignore the psychological and social importance of such questions almost altogether. My suggestion is that a proper world view, appropriate for its time, is generally one of the basic factors that is essential for harmony in the individual and in society as a whole.

In chapter 1 it is shown that science itself is demanding a new, non-fragmentary world view, in the sense that the present approach of analysis of the world into independently existent parts does not work very well in modern physics. It is shown that both in relativity theory and quantum theory, notions implying the undivided wholeness of the universe would provide a much more orderly way of considering the general nature of reality.

In chapter 2 we go into the role of language in bringing about fragmentation of thought. It is pointed out that the subject-verb-object structure of modern languages implies that all action

arises in a separate subject, and acts either on a separate object, or else reflexively on itself. This pervasive structure leads in the whole of life to a function that divides the totality of existence into separate entities, which are considered to be essentially fixed and static in their nature. We then inquire whether it is possible to experiment with new language forms in which the basic role will be given to the verb rather than to the noun. Such forms will have as their content a series of actions that flow and merge into each other, without sharp separations or breaks. Thus, both in form and in content, the language will be in harmony with the unbroken flowing movement of existence as a whole.

What is proposed here is not a new language as such but, rather, a new *mode* of using the existing language – the *rheomode* (flowing mode). We develop such a mode as a form of experimentation with language, which is intended mainly to give insight into the fragmentary function of the common language rather than to provide a new way of speaking that can be used for practical communications.

In chapter 3 the same questions are considered within a different context. It begins with a discussion of how reality can be considered as in essence a set of forms in an underlying universal movement or process, and then asks how our knowledge can be considered in the same manner. Thus, the way could be opened for a world view in which consciousness and reality would not be fragmented from each other. This question is discussed at length and we arrive at the notion that our general world view is itself an overall movement of thought, which has to be viable in the sense that the totality of activities that flow out of it are generally in harmony, both in themselves and with regard to the whole of existence. Such harmony is seen to be possible only if the world view itself takes part in an unending process of development, evolution, and unfoldment, which fits as part of the universal process that is the ground of all existence.

The next three chapters are rather more technical and mathematical. However, large parts of them should be comprehensible to the non-technical reader, as the technical parts are not entirely necessary for comprehension, although they add significant content for those who can follow them.

Chapter 4 deals with hidden variables in the quantum theory. The quantum theory is, at present, the most basic way available in physics for understanding the fundamental and universal laws relating to matter and its movement. As such, it must clearly be given serious consideration in any attempt to develop an overall world viewing.

The quantum theory, as it is now constituted, presents us with a very great challenge, if we are at all interested in such a venture, for in this theory there is no consistent notion at all of what the reality may be that underlies the universal constitution and structure of matter. Thus, if we try to use the prevailing world view based on the notion of particles, we discover that the 'particles' (such as electrons) can also manifest as waves, that they can move discontinuously, that there are no laws at all that apply in detail to the actual movements of individual particles and that only statistical predictions can be made about large aggregates of such particles. If on the other hand we apply the world view in which the universe is regarded as a continuous field, we find that this field must also be discontinuous, as well as particle-like, and that it is as undermined in its actual behaviour as is required in the particle view of relation as a whole.

It seems clear, then, that we are faced with deep and radical fragmentation, as well as thoroughgoing confusion, if we try to think of what could be the reality that is treated by our physical laws. At present physicists tend to avoid this issue by adopting the attitude that our overall views concerning the nature of reality are of little or no importance. All that counts in physical theory is supposed to be the development of mathematical equations that permit us to predict and control the behaviour of large

statistical aggregates of particles. Such a goal is not regarded as merely for its pragmatic and technical utility: rather, it has become a presupposition of most work in modern physics that prediction and control of this kind is all that human knowledge is about.

This sort of presupposition is indeed in accord with the general spirit of our age, but it is my main proposal in this book that we cannot thus simply dispense with an overall world view. If we try to do so, we will find that we are left with whatever (generally inadequate) world views may happen to be at hand. Indeed, one finds that physicists are not actually able just to engage in calculations aimed at prediction and control: they do find it necessary to use images based on *some* kind of general notions concerning the nature of reality, such as 'the particles that are the building blocks of the universe'; but these images are now highly confused (e.g. these particles move discontinuously and are also waves). In short, we are here confronted with an example of how deep and strong is the need for *some* kind of notion of reality in our thinking, even if it be fragmentary and muddled.

My suggestion is that at each stage the proper order of operation of the mind requires an overall grasp of what is generally known not only in formal, logical, mathematical terms, but also intuitively, in images, feelings, poetic usage of language, etc. (Perhaps we could say that this is what is involved in harmony between the 'left brain' and the 'right brain'.) This kind of overall way of thinking is not only a fertile source of new theoretical ideas: it is needed for the human mind to function in a generally harmonious way, which could in turn help to make possible an orderly and stable society. As indicated in the earlier chapters, however, this requires a continual flow and development of our general notions of reality.

Chapter 4 is then concerned with *making a beginning* in the process of developing a coherent view of what kind of reality might

be the basis of the correct mathematical predictions achieved in the quantum theory. Such attempts have generally been received among the community of physicists in a somewhat confused way, for it is widely felt that if there is to be any general world view it should be taken as the 'received' and 'final' notion concerning the nature of reality. But my attitude has, from the beginning, been that our notions concerning cosmology and the general nature of reality are in a continuous process of development, and that one may have to start with ideas that are merely some sort of improvement over what has thus far been available, and to go on from there to ideas that are better. Chapter 4 presents the real and severe problems that confront any attempt to provide a consistent notion of 'quantum-mechanical reality', and indicates a certain preliminary approach to a solution of these problems in terms of hidden variables.

In chapter 5 a different approach to the same problems is explored. This is an inquiry into our basic notions of order. Order in its totality is evidently ultimately undefinable, in the sense that it pervades everything that we are and do (language, thought, feeling, sensation, physical action, the arts, practical activity, etc.). However, in physics the basic order has for centuries been that of the Cartesian rectilinear grid (extended slightly in the theory of relativity to the curvilinear grid). Physics has had an enormous development during this time, with the appearance of many radically new features, but the basic order has remained essentially unchanged.

The Cartesian order is suitable for analysis of the world into separately existent parts (e.g. particles or field elements). In this chapter, however, we look into the nature of order with greater generality and depth, and discover that both in relativity and in quantum theory the Cartesian order is leading to serious contradictions and confusion. This is because both theories imply that the actual state of affairs is unbroken wholeness of the universe, rather than analysis into independent parts. Nevertheless, the

two theories differ radically in their detailed notions of order. Thus, in relativity, movement is continuous, causally determinate and well defined, while in quantum mechanics it is discontinuous, not causally determinate and not well defined. Each theory is committed to its own notions of essentially static and fragmentary modes of existence (relativity to that of separate events, connectable by signals, and quantum mechanics to a well-defined quantum state). One thus sees that a new kind of theory is needed which drops these basic commitments and at most recovers some essential features of the older theories as abstract forms derived from a deeper reality in which what prevails is unbroken wholeness.

In chapter 6 we go further to begin a more concrete development of a new notion of order, that may be appropriate to a universe of unbroken wholeness. This is the *implicate* or *enfolded* order. In the enfolded order, space and time are no longer the dominant factors determining the relationships of dependence or independence of different elements. Rather, an entirely different sort of basic connection of elements is possible, from which our ordinary notions of space and time, along with those of separately existent material particles, are abstracted as forms derived from the deeper order. These ordinary notions in fact appear in what is called the *explicate* or *unfolded* order, which is a special and distinguished form contained within the general totality of all the implicate orders.

In chapter 6 the implicate order is introduced in a general way, and discussed mathematically in an appendix. The seventh and last chapter, however, is a more developed (though non-technical) presentation of the implicate order, along with its relationship to consciousness. This leads to an indication of some lines along which it may be possible to meet the urgent challenge to develop a cosmology and set of general notions concerning the nature of reality that are proper to our time.

Finally, it is hoped that the presentation of the material in

these essays may help to convey to the reader how the subject itself has actually unfolded, so that the form of the book is, as it were, an example of what may be meant by the content.

1

FRAGMENTATION AND WHOLENESS

The title of this chapter is 'Fragmentation and wholeness'. It is especially important to consider this question today, for fragmentation is now very widespread, not only throughout society, but also in each individual; and this is leading to a kind of general confusion of the mind, which creates an endless series of problems and interferes with our clarity of perception so seriously as to prevent us from being able to solve most of them.

Thus art, science, technology, and human work in general, are divided up into specialities, each considered to be separate in essence from the others. Becoming dissatisfied with this state of affairs, men have set up further interdisciplinary subjects, which were intended to unite these specialities, but these new subjects have ultimately served mainly to add further separate fragments. Then, society as a whole has developed in such a way that it is broken up into separate nations and different religious, political, economic, racial groups, etc. Man's natural environment has

correspondingly been seen as an aggregate of separately existent parts, to be exploited by different groups of people. Similarly, each individual human being has been fragmented into a large number of separate and conflicting compartments, according to his different desires, aims, ambitions, loyalties, psychological characteristics, etc., to such an extent that it is generally accepted that some degree of neurosis is inevitable, while many individuals going beyond the 'normal' limits of fragmentation are classified as paranoid, schizoid, psychotic, etc.

The notion that all these fragments are separately existent is evidently an illusion, and this illusion cannot do other than lead to endless conflict and confusion. Indeed, the attempt to live according to the notion that the fragments are really separate is, in essence, what has led to the growing series of extremely urgent crises that is confronting us today. Thus, as is now well known, this way of life has brought about pollution, destruction of the balance of nature, over-population, world-wide economic and political disorder, and the creation of an overall environment that is neither physically nor mentally healthy for most of the people who have to live in it. Individually there has developed a widespread feeling of helplessness and despair, in the face of what seems to be an overwhelming mass of disparate social forces, going beyond the control and even the comprehension of the human beings who are caught up in it.

Indeed, to some extent, it has always been both necessary and proper for man, in his thinking, to divide things up, and to separate them, so as to reduce his problems to manageable proportions; for evidently, if in our practical technical work we tried to deal with the whole of reality all at once, we would be swamped. So, in certain ways, the creation of special subjects of study and the division of labour was an important step forward. Even earlier, man's first realization that he was not identical with nature was also a crucial step, because it made possible a kind of autonomy in his thinking, which allowed him to go beyond the

immediately given limits of nature, first in his imagination and ultimately in his practical work.

Nevertheless, this sort of ability of man to separate himself from his environment and to divide and apportion things ultimately led to a wide range of negative and destructive results, because man lost awareness of what he was doing and thus extended the process of division beyond the limits within which it works properly. In essence, the process of division is a way of *thinking about things* that is convenient and useful mainly in the domain of practical, technical and functional activities (e.g., to divide up an area of land into different fields where various crops are to be grown). However, when this mode of thought is applied more broadly to man's notion of himself and the whole world in which he lives (i.e. to his self-world view), then man ceases to regard the resulting divisions as merely useful or convenient and begins to see and experience himself and his world as actually constituted of separately existent fragments. Being guided by a fragmentary self-world view, man then acts in such a way as to try to break himself and the world up, so that all seems to correspond to his way of thinking. Man thus obtains an apparent proof of the correctness of his fragmentary self-world view though, of course, he overlooks the fact that it is he himself, acting according to his mode of thought, who has brought about the fragmentation that now seems to have an autonomous existence, independent of his will and of his desire.

Men have been aware from time immemorial of this state of apparently autonomously existent fragmentation and have often projected myths of a yet earlier 'golden age', before the split between man and nature and between man and man had yet taken place. Indeed, man has always been seeking wholeness – mental, physical, social, individual.

It is instructive to consider that the word 'health' in English is based on an Anglo-Saxon word 'hale' meaning 'whole': that is, to be healthy is to be whole, which is, I think, roughly the

equivalent of the Hebrew 'shalem'. Likewise, the English 'holy' is based on the same root as 'whole'. All of this indicates that man has sensed always that wholeness or integrity is an absolute necessity to make life worth living. Yet, over the ages, he has generally lived in fragmentation.

Surely, the question of why all this has come about requires careful attention and serious consideration.

In this chapter, attention will be focused on the subtle but crucial role of our general forms of thinking in sustaining fragmentation and in defeating our deepest urges toward wholeness or integrity. In order to give the discussion a concrete content we shall to some extent talk in terms of current scientific research, which is a field that is relatively familiar to me (though, of course, the overall significance of the questions under discussion will also be kept in mind).

What will be emphasized, first of all in scientific research and later in a more general context, is that fragmentation is continually being brought about by the almost universal habit of taking the content of our thought for 'a description of the world as it is'. Or we could say that, in this habit, our thought is regarded as in direct correspondence with objective reality. Since our thought is pervaded with differences and distinctions, it follows that such a habit leads us to look on these as real divisions, so that the world is then seen and experienced as actually broken up into fragments.

The relationship between thought and reality that this thought is about is in fact far more complex than that of a mere correspondence. Thus, in scientific research, a great deal of our thinking is in terms of *theories*. The word 'theory' derives from the Greek 'theoria', which has the same root as 'theatre', in a word meaning 'to view' or 'to make a spectacle'. Thus, it might be said that a theory is primarily a form of *insight*, i.e. a way of looking at the world, and not a form of *knowledge* of how the world is.

In ancient times, for example, men had the theory that celestial matter was fundamentally different from earthly matter and that it was natural for earthly objects to fall while it was natural for celestial objects, such as the moon, to remain up in the sky. With the coming of the modern era, however, scientists began to develop the viewpoint that there was no essential difference between earthly matter and celestial matter. This implied, of course, that heavenly objects, such as the moon, ought to fall, but for a long time men did not notice this implication. In a sudden flash of insight Newton then *saw* that as the apple falls so does the moon, and so indeed do all objects. Thus, he was led to the theory of universal gravitation, in which all objects were seen as falling toward various centres (e.g. the earth, the sun, the planets, etc.). This constituted a new way of *looking* at the heavens, in which the movements of the planets were no longer seen through the ancient notion of an essential difference between heavenly and earthly matter. Rather, one considered these movements in terms of rates of fall of all matter, heavenly and earthly, toward various centres, and when something was seen not to be accounted for in this way, one looked for and often discovered new and as yet unseen planets toward which celestial objects were falling (thus demonstrating the relevance of this way of looking).

The Newtonian form of insight worked very well for several centuries but ultimately (like the ancient Greek insights that came before) it led to unclear results when extended into new domains. In these new domains, new forms of insight were developed (the theory of relativity and the quantum theory). These gave a radically different picture of the world from that of Newton (though the latter was, of course, found to be still valid in a limited domain). If we supposed that theories gave true knowledge, corresponding to 'reality as it is', then we would have to conclude that Newtonian theory was true until around 1900, after which it suddenly became false, while

relativity and quantum theory suddenly became the truth. Such an absurd conclusion does not arise, however, if we say that all theories are insights, which are neither true nor false but, rather, clear in certain domains, and unclear when extended beyond these domains. This means, however, that we do not equate theories with hypotheses. As the Greek root of the word indicates, a hypothesis is a supposition, that is, an idea that is 'put under' our reasoning, as a provisional base, which is to be tested experimentally for its truth or falsity. As is now well known, however, there can be no *conclusive* experimental proof of the truth or falsity of a *general* hypothesis which aims to cover the whole of reality. Rather, one finds (e.g., as in the case of the Ptolemaic epicycles or of the failure of Newtonian concepts just before the advent of relativity and quantum theory) that older theories become more and more unclear when one tries to use them to obtain insight into new domains. Careful attention to how this happens is then generally the main clue toward new theories that constitute further new forms of insight.

So, instead of supposing that older theories are falsified at a certain point in time, we merely say that man is continually developing new forms of insight, which are clear up to a point and then tend to become unclear. In this activity, there is evidently no reason to suppose that there is or will be a final form of insight (corresponding to absolute truth) or even a steady series of approximations to this. Rather, in the nature of the case, one may expect the unending development of new forms of insight (which will, however, assimilate certain key features of the older forms as simplifications, in the way that relativity theory does with Newtonian theory). As pointed out earlier, however, this means that our theories are to be regarded primarily as ways of looking at the world as a whole (i.e. world views) rather than as 'absolutely true knowledge of how things are' (or as a steady approach toward the latter).

When we look at the world through our theoretical insights,

the factual knowledge that we obtain will evidently be shaped and formed by our theories. For example, in ancient times the fact about the motions of the planets was described in terms of the Ptolemaic idea of epicycles (circles superimposed on circles). In Newton's time, this fact was described in terms of precisely determined planetary orbits, analysed through rates of fall toward various centres. Later came the fact as seen relativistically according to Einstein's concepts of space and time. Still later, a very different sort of fact was specified in terms of the quantum theory (which gives in general only a statistical fact). In biology, the fact is now described in terms of the theory of evolution, but in earlier times it was expressed in terms of fixed species of living beings.

More generally, then, given perception and action, our theoretical insights provide the main source of organization of our factual knowledge. Indeed, our overall experience is shaped in this way. As seems to have been first pointed out by Kant, all experience is organized according to the categories of our thought, i.e., on our ways of thinking about space, time, matter, substance, causality, contingency, necessity, universality, particularity, etc. It can be said that these categories are general forms of insight or ways of looking at everything, so that in a certain sense, they are a kind of theory (but, of course, this level of theory must have developed very early in man's evolution).

Clarity of perception and thought evidently requires that we be generally aware of how our experience is shaped by the insight (clear or confused) provided by the theories that are implicit or explicit in our general ways of thinking. To this end, it is useful to emphasize that experience and knowledge are one process, rather than to think that our knowledge is *about* some sort of separate experience. We can refer to this one process as experience-knowledge (the hyphen indicating that these are two inseparable aspects of one whole movement).

Now, if we are not aware that our theories are ever-changing

forms of insight, giving shape and form to experience in general, our vision will be limited. One could put it like this: experience with nature is very much like experience with human beings. If one approaches another man with a fixed 'theory' about him as an 'enemy' against whom one must defend oneself, he will respond similarly, and thus one's 'theory' will apparently be confirmed by experience. Similarly, nature will respond in accordance with the theory with which it is approached. Thus, in ancient times, men thought plagues were inevitable, and this thought helped make them behave in such a way as to propagate the conditions responsible for their spread. With modern scientific forms of insights man's behaviour is such that he ceases the insanitary modes of life responsible for spreading plagues and thus they are no longer inevitable.

What prevents theoretical insights from going beyond existing limitations and changing to meet new facts is just the belief that theories give true knowledge of reality (which implies, of course, that they need never change). Although our modern way of thinking has, of course, changed a great deal relative to the ancient one, the two have had one key feature in common: i.e. they are both generally 'blinkered' by the notion that theories give true knowledge about 'reality as it is'. Thus, both are led to confuse the forms and shapes induced in our perceptions by theoretical insight with a reality independent of our thought and our way of looking. This confusion is of crucial significance, since it leads us to approach nature, society, and the individual in terms of more or less fixed and limited forms of thought, and thus, apparently, to keep on confirming the limitations of these forms of thought in experience.

This sort of unending confirmation of limitations in our modes of thinking is particularly significant with regard to fragmentation, for as pointed out earlier, every form of theoretical insight introduces its own essential differences and distinctions (e.g., in ancient times an essential distinction was between

heavenly and earthly matter, while in Newtonian theory it was essential to distinguish the centres toward which all matter was falling). If we regard these differences and distinctions as ways of looking, as guides to perception, this does not imply that they denote separately existent substances or entities.

On the other hand, if we regard our theories as 'direct descriptions of reality as it is', then we will inevitably treat these differences and distinctions as divisions, implying separate existence of the various elementary terms appearing in the theory. We will thus be led to the illusion that the world is actually constituted of separate fragments and, as has already been indicated, this will cause us to act in such a way that we do in fact produce the very fragmentation implied in our attitude to the theory.

It is important to give some emphasis to this point. For example, some might say: 'Fragmentation of cities, religions, political systems, conflict in the form of wars, general violence, fratricide, etc., are the reality. Wholeness is only an ideal, toward which we should perhaps strive.' But this is not what is being said here. Rather, what should be said is that wholeness is what is real, and that fragmentation is the response of this whole to man's action, guided by illusory perception, which is shaped by fragmentary thought. In other words, it is just because reality is whole that man, with his fragmentary approach, will inevitably be answered with a correspondingly fragmentary response. So what is needed is for man to give attention to his habit of fragmentary thought, to be aware of it, and thus bring it to an end. Man's approach to reality may then be whole, and so the response will be whole.

For this to happen, however, it is crucial that man be aware of the activity of his thought *as such*; i.e. as a form of insight, a way of looking, rather than as a 'true copy of reality as it is'.

It is clear that we may have any number of different kinds of insights. What is called for is not an *integration* of thought, or a

kind of imposed unity, for any such imposed point of view would itself be merely another fragment. Rather, all our different ways of thinking are to be considered as different ways of looking at the one reality, each with some domain in which it is clear and adequate. One may indeed compare a theory to a particular view of some object. Each view gives only an appearance of the object in some aspect. The whole object is not perceived in any one view but, rather, it is grasped only *implicitly* as that single reality which is shown in all these views. When we deeply understand that our theories also work in this way, then we will not fall into the habit of seeing reality and acting toward it as if it were constituted of separately existent fragments corresponding to how it appears in our thought and in our imagination when we take our theories to be 'direct descriptions of reality as it is'.

Beyond a general awareness of the role of theories as indicated above, what is needed is to give special attention to those theories that contribute to the expression of our overall self-world views. For, to a considerable extent, it is in these world views that our general notions of the nature of reality and of the relationship between our thought and reality are implicity or explicitly formed. In this respect, the general theories of physics play an important part, because they are regarded as dealing with the universal nature of the matter out of which all is constituted, and the space and time in terms of which all material movement is described.

Consider, for example, the atomic theory, which was first proposed by Democritus more than 2,000 years ago. In essence, this theory leads us to look at the world as constituted of atoms, moving in the void. The ever-changing forms and characteristics of large-scale objects are now seen as the results of changing arrangements of the moving atoms. Evidently, this view was, in certain ways, an important mode of realization of wholeness, for it enabled men to understand the enormous variety of the whole world in terms of the movements of one single set of basic

constituents, through a single void that permeates the whole of existence. Nevertheless, as the atomic theory developed, it ultimately became a major support for a fragmentary approach to reality. For it ceased to be regarded as an insight, a way of looking, and men regarded instead as an absolute truth the notion that the whole of reality is actually constituted of nothing but 'atomic building blocks', all working together more or less mechanically.

Of course, to take any physical theory as an absolute truth must tend to fix the general forms of thought in physics and thus to contribute to fragmentation. Beyond this, however, the particular content of the atomic theory was such as to be especially conducive to fragmentation, for it was implicit in this content that the entire world of nature, along with the human being, including his brain, his nervous system, his mind, etc., could in principle be understood completely in terms of structures and functions of aggregates of separately existent atoms. The fact that in man's experiments and general experience this atomic view was confirmed was, of course, then taken as proof of the correctness and indeed the universal truth of this notion. Thus almost the whole weight of science was put behind the fragmentary approach to reality.

It is important to point out, however, that (as usually happens in such cases) the experimental confirmation of the atomic point of view is limited. Indeed, in the domains covered by quantum theory and relativity, the notion of atomism leads to confused questions, which indicate the need for new forms of insight, as different from atomism as the latter is from theories that came before it.

Thus, the quantum theory shows that the attempt to describe and follow an atomic particle in precise detail has little meaning. (Further detail on this point is given in chapter 5.) The notion of an atomic path has only a limited domain of applicability. In a more detailed description the atom is, in many ways, seen to

behave as much like a wave as a particle. It can perhaps best be regarded as a poorly defined cloud, dependent for its particular form on the whole environment, including the observing instrument. Thus, one can no longer maintain the division between the observer and observed (which is implicit in the atomistic view that regards each of these as separate aggregates of atoms). Rather, both observer and observed are merging and interpenetrating aspects of one whole reality, which is indivisible and unanalysable.

Relativity leads us to a way of looking at the world that is similar to the above in certain key respects (see chapter 5 for more detail on this point). From the fact that in Einstein's point of view no signal faster than light is possible, it follows that the concept of a rigid body breaks down. But this concept is crucial in the classical atomic theory, for in this theory the ultimate constituents of the universe have to be small indivisible objects, and this is possible only if each part of such an object is bound rigidly to all other parts. What is needed in a relativistic theory is to give up altogether the notion that the world is constituted of basic objects or 'building blocks'. Rather, one has to view the world in terms of universal flux of events and processes. Thus, as indicated by A and B in figure 1.1, instead of thinking of a particle, one is to think of a 'world tube'.

This world tube represents an infinitely complex process of a structure in movement and development which is centred in a region indicated by the boundaries of the tube. However, even outside the tube, each 'particle' has a field that extends through space and merges with the fields of other particles.

A more vivid image of the sort of thing that is meant is afforded by considering wave forms as vortex structures in a flowing stream. As shown in figure 1.2, two vortices correspond to stable patterns of flow of the fluid, centred more or less at A and B. Evidently, the two vortices are to be considered as abstractions, made to stand out in our perception by our way of

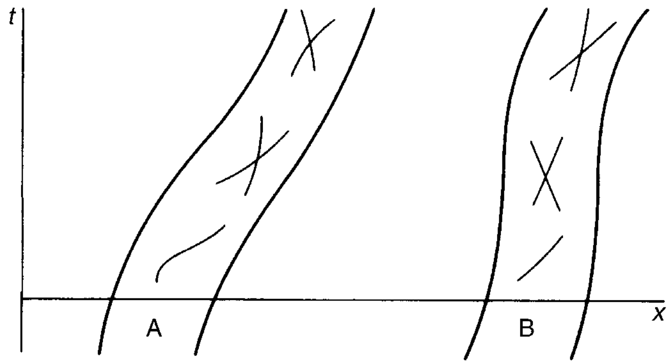

Figure 1.1

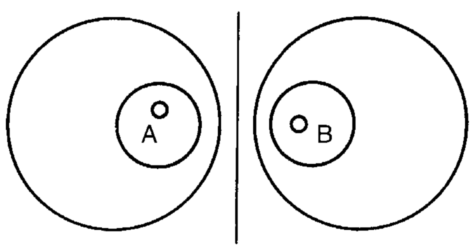

Figure 1.2

thinking. Actually, of course, the two abstracted flow patterns merge and unite, in one whole movement of the flowing stream. There is no sharp division between them, nor are they to be regarded as separately or independently existent entities.

Relativity theory calls for this sort of way of looking at the atomic particles, which constitute all matter, including of course human beings, with their brains, nervous systems, and the observing instruments that they have built and that they use in their laboratories. So, approaching the question in different ways, relativity and quantum theory agree, in that they both imply the need to look on the world as an *undivided whole*, in which all parts of the universe, including the observer and his instruments, merge and unite in one totality. In this totality, the

atomistic form of insight is a simplification and an abstraction, valid only in some limited context.

The new form of insight can perhaps best be called *Undivided Wholeness in Flowing Movement*. This view implies that flow is, in some sense, prior to that of the 'things' that can be seen to form and dissolve in this flow. One can perhaps illustrate what is meant here by considering the 'stream of consciousness'. This flux of awareness is not precisely definable, and yet it is evidently prior to the definable forms of thoughts and ideas which can be seen to form and dissolve in the flux, like ripples, waves and vortices in a flowing stream. As happens with such patterns of movement in a stream some thoughts recur and persist in a more or less stable way, while others are evanescent.

The proposal for a new general form of insight is that all matter is of this nature: That is, there is a universal flux that cannot be defined explicitly but which can be known only implicitly, as indicated by the explicitly definable forms and shapes, some stable and some unstable, that can be abstracted from the universal flux. In this flow, mind and matter are not separate substances. Rather, they are different aspects of one whole and unbroken movement. In this way, we are able to look on all aspects of existence as not divided from each other, and thus we can bring to an end the fragmentation implicit in the current attitude toward the atomic point of view, which leads us to divide everything from everything in a thoroughgoing way. Nevertheless, we can comprehend that aspect of atomism which still provides a correct and valid form of insight; i.e. that in spite of the undivided wholeness in flowing movement, the various patterns that can be abstracted from it have a certain relative autonomy and stability, which is indeed provided for by the universal law of the flowing movement. Now, however, we have the limits of this autonomy and stability sharply in mind.

Thus we can, in specified contexts, adopt other various forms of insight that enable us to simplify certain things and to treat

them momentarily and for certain limited purposes as if they were autonomous and stable, as well as perhaps separately existent. Yet we do not have to fall into the trap of looking at ourselves and at the whole world in this way. Thus our thought need no longer lead to the illusion that reality actually is of fragmentary nature, and to the corresponding fragmentary actions that arise out of perception clouded by such illusion.

The point of view discussed above is similar, in certain key ways, to that held by some of the Ancient Greeks. This similarity can be brought out by considering Aristotle's notion of causality. Aristotle distinguished four kinds of causes:

Material
Efficient
Formal
Final

A good example in terms of which this distinction can be understood is obtained by considering something living, such as a tree or an animal. The material cause is then just the matter in which all the other causes operate and out of which the thing is constituted. Thus, in the case of a plant, the material cause is the soil, air, water and sunlight, constituting the substance of the plant. The efficient cause is some action, external to the thing under discussion, which allows the whole process to get under way. In the case of a tree, for example, the planting of the seed could be taken as the efficient cause.

It is of crucial significance in this context to understand what was meant by formal cause. Unfortunately, in its modern connotation, the word 'formal' tends to refer to an outward form that is not very significant (e.g. as in 'formal dress' or 'a mere formality'). However, in the Ancient Greek philosophy, the word *form* meant, in the first instance, an inner *forming activity* which is the cause of the growth of things, and of the development and

differentiation of their various essential forms. For example, in the case of an oak tree, what is indicated by the term 'formal cause' is the whole inner movement of sap, cell growth, articulation of branches, leaves, etc., which is characteristic of that kind of tree and different from that taking place in other kinds of trees. In more modern language, it would be better to describe this as *formative cause*, to emphasize that what is involved is not a mere form imposed from without, but rather *an ordered and structured inner movement that is essential to what things are*.

Any such formative cause must evidently have an end or product which is at least implicit. Thus, it is not possible to refer to the inner movement from the acorn giving rise to an oak tree, without simultaneously referring to the oak tree that is going to result from this movement. So formative cause always implies final cause.

Of course, we also know final cause as *design*, consciously held in mind through thought (this notion being extended to God, who was regarded as having created the universe according to some grand design). Design is, however, only a special case of final cause. For example, men often aim toward certain ends in their thoughts but what actually emerges from their actions is generally something different from what was in their design, something that was, however, *implicit* in what they were doing, though not consciously perceived by those who took part.

In the ancient view, the notion of formative cause was considered to be of essentially the same nature for the mind as it was for life and for the cosmos as a whole. Indeed, Aristotle considered the universe as a single organism in which each part grows and develops in its relationship to the whole and in which it has its proper place and function. With regard to the mind, we can understand this sort of notion in more modern terms by turning our attention to the flowing movement of awareness. As indicated earlier, one can, in the first instance, discern various thought patterns in this flow. These follow on each other

relatively mechanically, through association determined by habit and conditioning. Evidently, such associative changes are external to the inner structure of the thoughts in question, so that these changes act like a series of efficient causes. However, to see the *reason* for something is not a mechanical activity of this nature: Rather, one is aware of each aspect as assimilated within a single whole, all of whose parts are inwardly related (as are, for example, the organs of the body). Here, one has to emphasize that the act of reason is essentially a kind of perception through the mind, similar in certain ways to artistic perception, and not merely the associative repetition of reasons that are already known. Thus, one may be puzzled by a wide range of factors, things that do not fit together, until suddenly there is a flash of understanding, and therefore one sees how all these factors are related as aspects of one totality (e.g. consider Newton's insight into universal gravitation). Such acts of perception cannot properly be given a detailed analysis or description. Rather, they are to be considered as aspects of the *forming* activity of the mind. A particular structure of concepts is then the *product* of this activity, and these products are what are linked by the series of efficient causes that operate in ordinary associative thinking – and as pointed out earlier, in this view, one regards the forming activity as primary in nature as it is in the mind, so that the product forms in nature are also what are linked by efficient causes.

Evidently, the notion of formative cause is relevant to the view of undivided wholeness in flowing movement, which has been seen to be implied in modern developments in physics, notably relativity theory and quantum theory. Thus, as has been pointed out, each relatively autonomous and stable structure (e.g., an atomic particle) is to be understood not as something independently and permanently existent but rather as a product that has been formed in the whole flowing movement and that will ultimately dissolve back into this movement. How it forms and maintains itself, then, depends on its place and function in the

whole. So, we see that certain developments in modern physics imply a sort of insight into nature that is in respect to the notions of formative and final cause, essentially similar to ways of looking that were common in earlier times.

Nevertheless, in most of the work that is being done in physics today the notions of formative and final cause are not regarded as having primary significance. Rather, law is still generally conceived as a self-determined system of efficient causes, operating in an ultimate set of material constituents of the universe (e.g. elementary particles subject to forces of interaction between them). These constituents are not regarded as formed in an overall process, and thus they are not considered to be anything like organs adapted to their place and function in the whole (i.e. to the ends which they would serve in this whole). Rather, they tend to be conceived as separately existent mechanical elements of a fixed nature.

The prevailing trend in modern physics is thus much against any sort of view giving primacy to formative activity in undivided wholeness of flowing movement. Indeed, those aspects of relativity theory and quantum theory which do suggest the need for such a view tend to be de-emphasized and in fact hardly noticed by most physicists, because they are regarded largely as features of the mathematical calculus and not as indications of the real nature of things. When it comes to the informal language and mode of thought in physics, which infuses the imagination and provokes the sense of what is real and substantial, most physicists still speak and think, with an utter conviction of truth, in terms of the traditional atomistic notion that the universe is constituted of elementary particles which are 'basic building blocks' out of which everything is made. In other sciences, such as biology, the strength of this conviction is even greater, because among workers in these fields there is little awareness of the revolutionary character of development in modern physics. For example, modern molecular biologists

generally believe that the whole of life and mind can ultimately be understood in more or less mechanical terms, through some kind of extension of the work that has been done on the structure and function of DNA molecules. A similar trend has already begun to dominate in psychology. Thus we arrive at the very odd result that in the study of life and mind, which are just the fields in which formative cause acting in undivided and unbroken flowing movement is most evident to experience and observation, there is now the strongest belief in the fragmentary atomistic approach to reality.

Of course, the prevailing tendency in science to think and perceive in terms of a fragmentary self-world view is part of a larger movement that has been developing over the ages and that pervades almost the whole of our society today: but, in turn, such a way of thinking and looking in scientific research tends very strongly to re-enforce the general fragmentary approach because it gives men a picture of the whole world as constituted of nothing but an aggregate of separately existent 'atomic building blocks', and provides experimental evidence from which is drawn the conclusion that this view is necessary and inevitable. In this way, people are led to feel that fragmentation is nothing but an expression of 'the way everything really is' and that anything else is impossible. So there is very little disposition to look for evidence to the contrary. Indeed, as has already been pointed out, even when such evidence does arise, as in modern physics, the general tendency is to minimize its significance or even to ignore it altogether. One might in fact go so far as to say that in the present state of society, and in the present general mode of teaching science, which is a manifestation of this state of society, a kind of prejudice in favour of a fragmentary self-world view is fostered and transmitted (to some extent explicitly and consciously but mainly in an implicit and unconscious manner).

As has been indicated, however, men who are guided by such

a fragmentary self-world view cannot, in the long run, do other than to try in their actions to break themselves and the world into pieces, corresponding to their general mode of thinking. Since, in the first instance, fragmentation is an attempt to extend the analysis of the world into separate parts beyond the domain in which to do this is appropriate, it is in effect an attempt to divide what is really indivisible. In the next step such an attempt will lead us also to try to unite what is not really unitable. This can be seen especially clearly in terms of groupings of people in society (political, economic, religious, etc.). The very act of forming such a group tends to create a sense of division and separation of the members from the rest of the world but, because the members are really connected with the whole, this cannot work. Each member has in fact a somewhat different connection, and sooner or later this shows itself as a difference between him and other members of the group. Whenever men divide themselves from the whole of society and attempt to unite by identification within a group, it is clear that the group must eventually develop internal strife, which leads to a breakdown of its unity. Likewise when men try to separate some aspect of nature in their practical, technical work, a similar state of contradiction and disunity will develop. The same sort of thing will happen to the individual when he tries to separate himself from society. True unity in the individual and between man and nature, as well as between man and man, can arise only in a form of action that does not attempt to fragment the whole of reality.

Our fragmentary way of thinking, looking, and acting, evidently has implications in every aspect of human life. That is to say, by a rather interesting sort of irony, fragmentation seems to be the one thing in our way of life which is universal, which works through the whole without boundary or limit. This comes about because the roots of fragmentation are very deep and pervasive. As pointed out, we try to divide what is one and

indivisible, and this implies that in the next step we will try to identify what is different.

So fragmentation is in essence a confusion around the question of difference and sameness (or one-ness), but the clear perception of these categories is necessary in every phase of life. *To be confused about what is different and what is not, is to be confused about everything*. Thus, it is not an accident that our fragmentary form of thought is leading to such a widespread range of crises, social, political, economic, ecological, psychological, etc., in the individual and in society as a whole. Such a mode of thought implies unending development of chaotic and meaningless conflict, in which the energies of all tend to be lost by movements that are antagonistic or else at cross-purposes.

Evidently, it is important and indeed extremely urgent to clear up this deep and pervasive kind of confusion that penetrates the whole of our lives. What is the use of attempts at social, political, economic or other action if the mind is caught up in a confused movement in which it is generally differentiating what is not different and identifying what is not identical? Such action will be at best ineffective and at worst really destructive.

Nor will it be useful to try to impose some fixed kind of integrating or unifying 'holistic' principle on our self-world view, for, as indicated earlier, any form of fixed self-world view implies that we are no longer treating our theories as insights or ways of looking but, rather, as 'absolutely true knowledge of things as they really are'. So, whether we like it or not, the distinctions that are inevitably present in every theory, even an 'holistic' one, will be falsely treated as divisions, implying separate existence of the terms that are distinguished (so that, correspondingly, what is not distinguished in this way will be falsely treated as absolutely identical).

We have thus to be alert to give careful attention and serious consideration to the fact that our theories are not 'descriptions of reality as it is' but, rather, ever-changing forms of insight,

which can point to or indicate a reality that is implicit and not describable or specifiable in its totality. This need for being thus watchful holds even for what is being said here in this chapter, in the sense that this is not to be regarded as 'absolutely true knowledge of the nature of fragmentations and wholeness'. Rather, it too is *a theory* that gives insight into this question. It is up to the reader to see for himself whether the insight is clear or unclear and what are the limits of its validity.

What, then, can be done to end the prevailing state of fragmentation? At first sight this may seem to be a reasonable question but a closer examination leads one to ask whether it is in fact a reasonable question, for one can see that this question has presuppositions that are not clear.

Generally speaking, if one asks how one can solve some technical problem, for example, it is presupposed that while we begin not knowing the answer, our minds are nevertheless clear enough to discover an answer, or at least to recognize someone else's discovery of an answer. But if our whole way of thinking is penetrated by fragmentation, this implies that we are not capable of this, for fragmentary perception is in essence a largely unconscious habit of confusion around the question of what is different and what is not. So, in the very act in which we try to discover what to do about fragmentation, we will go on with this habit and thus we will tend to introduce yet further forms of fragmentation.

This does not necessarily mean, of course, that there is no way out at all, but it does mean that we have to give pause so that we do not go with our habitual fragmentary ways of thinking as we seek solutions that are ready to hand. The question of fragmentation and wholeness is a subtle and difficult one, more subtle and difficult than those which lead to fundamentally new discoveries in science. To ask how to end fragmentation and to expect an answer in a few minutes makes even less sense than to ask how to develop a theory as new as Einstein's was when he was working

on it, and to expect to be told what to do in terms of some programme, expressed in terms of formulae or recipes.

One of the most difficult and subtle points about this question is just to clarify what is to be meant by the relationship between the content of thought and the process of thinking which produces this content. A major source of fragmentation is indeed the generally accepted presupposition that the process of thought is sufficiently separate from and independent of its content, to allow us generally to carry out clear, orderly, rational thinking, which can properly judge this content as correct or incorrect, rational or irrational, fragmentary or whole, etc. Actually, as has been seen, the fragmentation involved in a self-world view is not only in the content of thought, but in the general activity of the person who is 'doing the thinking', and thus, it is as much in the process of thinking as it is in the content. Indeed, content and process are not two separately existent things, but, rather, they are two aspects of views of one whole movement. Thus fragmentary content and fragmentary process have to come to an end *together*.

What we have to deal with here is a one-ness of the thinking process and its content, similar in key ways to the one-ness of observer and observed; that has been discussed in connection with relativity theory and quantum theory. Questions of this nature cannot be met properly while we are caught up, consciously or unconsciously, in a mode of thought which attempts to analyse itself in terms of a presumed separation between the process of thinking and the content of thought that is its product. By accepting such a presumption we are led, in the next step, to seek some fantasy of action through efficient causes that would end the fragmentation in the content while leaving the fragmentation in the actual process of thinking untouched. What is needed, however, is somehow to grasp the overall *formative cause* of fragmentation, in which content and actual process are seen together, in their wholeness.

One might here consider the image of a turbulent mass of vortices in a stream. The structure and distribution of vortices, which constitute a sort of content of the description of the movement, are not separate from the formative activity of the flowing stream, which creates, maintains, and ultimately dissolves the totality of vortex structures. So to try to eliminate the vortices without changing the formative activity of the stream would evidently be absurd. Once our perception is guided by the proper insight into the significance of the whole movement, we will evidently not be disposed to try such a futile approach. Rather, we will look at the whole situation, and be attentive and alert to learn about it, and thus to discover what is really an appropriate sort of action, relevant to this whole, for bringing the turbulent structure of vortices to an end. Similarly, when we really grasp the truth of the one-ness of the thinking process that we are actually carrying out, and the content of thought that is the product of this process, then such insight will enable us to observe, to look, to learn about the whole movement of thought and thus to discover an action relevant to this whole, that will end the 'turbulence' of movement which is the essence of fragmentation in every phase of life.

Of course, such learning and discovery will require a great deal of careful attention and hard work. We are ready to give such attention and work in a wide range of fields, scientific, economic, social, political, etc. As yet, however, little or none of this has gone into the creation of insight into the process of thought, on the clarity of which the value of all else depends. What is primarily needed is a growing realization of the extremely great danger of going on with a fragmentary process of thought. Such a realization would give the inquiry into how thought actually operates that sense of urgency and energy required to meet the true magnitude of the difficulties with which fragmentation is now confronting us.

APPENDIX: RÉSUMÉ OF DISCUSSION ON WESTERN AND EASTERN FORMS OF INSIGHT INTO WHOLENESS

In the very early phases of the development of civilization, man's views were essentially of wholeness rather than of fragmentation. In the East (especially in India) such views still survive, in the sense that philosophy and religion emphasize wholeness and imply the futility of analysis of the world into parts. Why, then, do we not drop our fragmentary Western approach and adopt these Eastern notions which include not only a self-world view that denies division and fragmentation but also techniques of meditation that lead the whole process of mental operation non-verbally to the sort of quiet state of orderly and smooth flow needed to end fragmentation both in the actual process of thought and in its content?

To answer such a question, it is useful to begin by going into the difference between Western and Eastern notions of measure. Now, in the West the notion of measure has, from very early times, played a key role in determining the general self-world view and the way of life implicit in such a view. Thus among the Ancient Greeks, from whom we derive a large part of our fundamental notions (by way of the Romans), to keep everything in its right measure was regarded as one of the essentials of a good life (e.g. Greek tragedies generally portrayed man's suffering as a consequence of his going beyond the proper measure of things). In this regard, measure was not looked on in its modern sense as being primarily some sort of comparison of an object with an external standard or unit. Rather, this latter procedure was regarded as a kind of outward display or appearance of a deeper 'inner measure', which played an essential role in everything. When something went beyond its proper measure, this meant not merely that it was not conforming to some external standard of what was right but, much more, that it was inwardly out of

harmony, so that it was bound to lose its integrity and break up into fragments. One can obtain some insight into this way of thinking by considering the earlier meanings of certain words. Thus, the Latin 'mederi' meaning 'to cure' (the root of the modern 'medicine') is based on a root meaning 'to measure'. This reflects the view that physical health is to be regarded as the outcome of a state of right inward measure in all parts and processes of the body. Similarly, the word 'moderation', which describes one of the prime ancient notions of virtue, is based on the same root, and this shows that such virtue was regarded as the outcome of a right inner measure underlying man's social actions and behaviour. Again, the word 'meditation', which is based on the same root, implies a kind of weighing, pondering, or measuring of the whole process of thought, which could bring the inner activities of the mind to a state of harmonious measure. So, physically, socially and mentally, awareness of the inner measure of things was seen as the essential key to a healthy, happy, harmonious life.

It is clear that measure is to be expressed in more detail through proportion or ratio; and 'ratio' is the Latin word from which our modern 'reason' is derived. In the ancient view, reason is seen as insight into a totality of ratio or proportion, regarded as relevant inwardly to the very nature of things (and not only outwardly as a form of comparison with a standard or unit). Of course, this ratio is not necessarily merely a numerical proportion (though it does, of course, include such proportion). Rather, it is in general a qualitative sort of universal proportion or relationship. Thus, when Newton perceived the insight of universal gravitation, what he saw could be put in this way: 'As the apple falls, so does the moon, and so indeed does everything.' To exhibit the form of the ratio yet more explicitly, one can write:

$$A : B :: C : D :: E : F$$

where *A* and *B* represent successive positions of the apple at successive moments of time, *C* and *D* those of the moon, and *E* and *F* those of any other object.

Whenever we find a theoretical reason for something, we are exemplifying this notion of ratio, in the sense of implying that as the various aspects are related in our idea, so they are related in the thing that the idea is about. The essential reason or ratio of a thing is then the totality of inner proportions in its structure, and in the process in which it forms, maintains itself, and ultimately dissolves. In this view, to understand such ratio is to understand the 'innermost being' of that thing.

It is thus implied that measure is a form of insight into the essence of everything, and that man's perception, following on ways indicated by such insight, will be clear and will thus bring about generally orderly action and harmonious living. In this connection, it is useful to call to mind Ancient Greek notions of measure in music and in the visual arts. These notions emphasized that a grasp of measure was a key to the understanding of harmony in music (e.g., measure as rhythm, right proportion in intensity of sound, right proportion in tonality, etc.). Likewise, in the visual arts, right measure was seen as essential to overall harmony and beauty (e.g., consider the 'Golden Mean'). All of this indicates how far the notion of measure went beyond that of comparison with an external standard, to point to a universal sort of inner ratio or proportion, perceived both through the senses and through the mind.

Of course, as time went on, this notion of measure gradually began to change, to lose its subtlety and to become relatively gross and mechanical. Probably this was because man's notion of measure became more and more routinized and habitual, both with regard to its outward display in measurements relative to an external unit and to its inner significance as universal ratio relevant to physical health, social order, and mental harmony. Men began to learn such notions of measure mechanically, by

conforming to the teachings of their elders or their masters, and not creatively through an inner feeling and understanding of the deeper meaning of the ratio or proportion which they were learning. So measure gradually came to be taught as a sort of rule that was to be imposed from outside on the human being, who in turn imposed the corresponding measure physically, socially and mentally, in every context in which he was working. As a result, the prevailing notions of measure were no longer seen as forms of insight. Rather, they appeared to be 'absolute truths about reality as it is', which men seemed always to have known, and whose origin was often explained mythologically as binding injunctions of the Gods, which it would be both dangerous and wicked to question. Thought about measure thus tended to fall mainly into the domain of unconscious habit and, as a result, the forms induced in perception by this thought were now seen as directly observed objective realities, which were essentially independent of how they were thought about.

Even by the time of the Ancient Greeks, this process had gone a long way and, as men realized this, they began to question the notion of measure. Thus Protagoras said: 'Man is the measure of all things', thus emphasizing that measure is not a reality external to man, existing independently of him. But many who were in the habit of looking at everything externally also applied this way of looking to what Protagoras said. Thus, they concluded that measure was something arbitrary, and subject to the capricious choice or taste of each individual. In this way they of course overlooked the fact that measure is a form of insight that has to fit the overall reality in which man lives, as demonstrated by the clarity of perception and harmony of action to which it leads. Such insight can arise properly only when a man works with seriousness and honesty, putting truth and factuality first, rather than his own whims or desires.

The general rigidification and objectification of the notion of measure continued to develop until, in modern times, the very

word 'measure' has come to denote mainly a process of comparison of something with an external standard. While the original meaning still survives in some contexts (e.g., art and mathematics) it is generally felt as having only a secondary sort of significance.

Now, in the East the notion of measure has not played nearly so fundamental a role. Rather, in the prevailing philosophy in the Orient, the immeasurable (i.e. that which cannot be named, described, or understood through any form of reason) is regarded as the primary reality. Thus, in Sanskrit (which has an origin common to the Indo-European language group) there is a word 'matra' meaning 'measure', in the musical sense, which is evidently close to the Greek 'metron'. But then there is another word 'maya' obtained from the same root, which means 'illusion'. This is an extraordinarily significant point. Whereas to Western society, as it derives from the Greeks, measure, with all that this word implies, is the very essence of reality, or at least the key to this essence, in the East measure has now come to be regarded commonly as being in some way false and deceitful. In this view the entire structure and order of forms, proportions, and 'ratios' that present themselves to ordinary perception and reason are regarded as a sort of veil, covering the true reality, which cannot be perceived by the senses and of which nothing can be said or thought.

It is clear that the different ways the two societies have developed fit in with their different attitudes to measure. Thus, in the West, society has mainly emphasized the development of science and technology (dependent on measure) while in the East, the main emphasis has gone to religion and philosophy (which are directed ultimately toward the immeasurable).

If one considers this question carefully, one can see that in a certain sense the East was right to see the immeasurable as the primary reality. For, as has already been indicated, measure is an insight created by man. A reality that is beyond man and prior to

him cannot depend on such insight. Indeed, the attempt to suppose that measure exists prior to man and independently of him leads, as has been seen, to the 'objectification' of man's insight, so that it becomes rigidified and unable to change, eventually bringing about fragmentation and general confusion in the way described in this chapter.

One may speculate that perhaps in ancient times, the men who were wise enough to see that the immeasurable is the primary reality were also wise enough to see that measure is insight into a secondary and dependent but nonetheless necessary aspect of reality. Thus they may have agreed with the Greeks that insight into measure is capable of helping to bring about order and harmony in our lives, while at the same time, seeing perhaps more deeply, that it cannot be what is most fundamental in this regard.

What they may further have said is that when measure is identified with the very essence of reality, *this* is illusion. But then, when men learned this by conforming to the teachings of tradition, the meaning became largely habitual and mechanical. In the way indicated earlier, the subtlety was lost and men began to say simply: 'measure is illusion'. Thus, both in the East and in the West, true insight may have been turned into something false and misleading by the procedure of learning mechanically through conformity to existent teachings, rather than through a creative and original grasp of the insights implicit in such teachings.

It is of course impossible to go back to a state of wholeness that may have been present before the split between East and West developed (if only because we know little, if anything, about this state). Rather, what is needed is to learn afresh, to observe, and to discover for ourselves the meaning of wholeness. Of course, we have to be cognisant of the teachings of the past, both Western and Eastern, but to imitate these teachings or to try to conform to them would have little value. For, as has been

pointed out in this chapter, to develop new insight into fragmentation and wholeness requires a creative work even more difficult than that needed to make fundamental new discoveries in science, or great and original works of art. It might in this context be said that one who is similar to Einstein in creativity is not the one who imitates Einstein's ideas, nor even the one who applies these ideas in new ways, rather, it is the one who learns from Einstein and then goes on to do something original, which is able to assimilate what is valid in Einstein's work and yet goes beyond this work in qualitatively new ways. So what we have to do with regard to the great wisdom from the whole of the past, both in the East and in the West, is to assimilate it and to go on to new and original perception relevant to our present condition of life.

In doing this, it is important that we be clear on the role of techniques, such as those used in various forms of meditation. In a way, techniques of meditation can be looked on as measures (actions ordered by knowledge and reason) which are taken by man to try to reach the immeasurable, i.e., a state of mind in which he ceases to sense a separation between himself and the whole of reality. But clearly, there is a contradiction in such a notion, for the immeasurable is, if anything, just that which cannot be brought within limits determined by man's knowledge and reason.

To be sure, in certain specifiable contexts, technical measures, understood in a right spirit, can lead us to do things from which we can derive insight if we are observant. Such possibilities, however, are limited. Thus, it would be a contradiction in terms to think of formulating techniques for making fundamental new discoveries in science or original and creative works of art, for the very essence of such action is a certain freedom from dependence on others, who would be needed as guides. How can this freedom be transmitted in an activity in which conformity to someone else's knowledge is the main source of energy?

And if techniques cannot teach originality and creativity in art and science, how much less is it possible for them to enable us to 'discover the immeasurable'?

Actually, there are no direct and positive things that man can do to get in touch with the immeasurable, for this must be immensely beyond anything that man can grasp with his mind or accomplish with his hands or his instruments. What man *can* do is to give his full attention and creative energies to bring clarity and order into the totality of the field of measure. This involves, of course, not only the outward display of measure in terms of external units but also inward measure, as health of the body, moderation in action, and meditation, which gives insight into the measure of thought. This latter is particularly important because, as has been seen, the illusion that the self and the world are broken into fragments originates in the kind of thought that goes beyond its proper measure and confuses its own product with the same independent reality. To end this illusion requires insight, not only into the world as a whole, but also into how the instrument of thought is working. Such insight implies an original and creative act of perception into all aspects of life, mental and physical, both through the senses and through the mind, and this is perhaps the true meaning of meditation.

As has been seen, fragmentation originates in essence in the fixing of the insights forming our overall self-world view, which follows on our generally mechanical, routinized and habitual modes of thought about these matters. Because the primary reality goes beyond anything that can be contained in such fixed forms of measure, these insights must eventually cease to be adequate, and will thus give rise to various forms of unclarity or confusion. However, when the whole field of measure is open to original and creative insight, without any fixed limits or barriers, then our overall world views will cease to be rigid, and the whole field of measure will come into harmony, as fragmentation within it comes to an end. But original and creative insight

within the whole field of measure *is* the action of the immeasurable. For when such insight occurs, the source cannot be within ideas already contained in the field of measure but rather has to be in the immeasurable, which contains the essential formative cause of all that happens in the field of measure. The measurable and the immeasurable are then in harmony and indeed one sees that they are but different ways of considering the one and undivided whole.

When such harmony prevails, man can then not only have insight into the meaning of wholeness but, what is much more significant, he can realize the truth of this insight in every phase and aspect of his life.

As Krishnamurti[1] has brought out with great force and clarity, this requires that man gives his full creative energies to the inquiry into the whole field of measure. To do this may perhaps be extremely difficult and arduous, but since everything turns on this, it is surely worthy of the serious attention and utmost consideration of each of us.

2

THE RHEOMODE – AN EXPERIMENT WITH LANGUAGE AND THOUGHT

1 INTRODUCTION

In the previous chapter it has been pointed out that our thought is fragmented, mainly by our taking it for an image or model of 'what the world is'. The divisions in thought are thus given disproportionate importance, as if they were a widespread and pervasive structure of independently existent actual breaks in 'what is', rather than merely convenient features of description and analysis. Such thought was shown to bring about a thoroughgoing confusion that tends to permeate every phase of life, and that ultimately makes impossible the solution of individual and social problems. We saw the urgent need to end this confusion, through giving careful attention to the one-ness of the content of thought and the actual process of thinking which produces this content.

In this chapter the main emphasis will be to inquire into the

role of language structure in helping to bring about this sort of fragmentation in thought. Though language is only *one* of the important factors involved in this tendency, it is clearly of key importance in thought, in communication, and in the organization of human society in general.

Of course, it is possible merely to observe language as it is, and has been, in various differing social groups and periods of history, but what we wish to do in this chapter is to *experiment* with changes in the structure of the common language. In this experimentation our aim is not to produce a well-defined alternative to present language structures. Rather, it is to see what happens to the language function as we change it, and thus perhaps to make possible a certain insight into how language contributes to the general fragmentation. Indeed, one of the best ways of learning how one is conditioned by a habit (such as the common usage of language is, to a large extent) is to give careful and sustained attention to one's overall reaction when one 'makes the test' of seeing what takes place when one is doing something significantly different from the automatic and accustomed function. So, the main point of the work discussed in this chapter is to take a step in what might be an unending experimentation with language (and with thought). That is, we are suggesting that such experimentation is to be considered as a normal activity of the individual and of society (as it has in fact come to be considered over the past few centuries with regard to experimentation with nature and with man himself). Thus, language (along with the thought involved in it) will be seen as a particular field of function among all the rest, so that it ceases to be, in effect, the one field that is exempted from experimental inquiry.

2 AN INQUIRY INTO OUR LANGUAGE

In scientific inquiries a crucial step is to ask the right question. Indeed, each question contains presuppositions, largely implicit. If these presuppositions are wrong or confused, then the question itself is wrong, in the sense that to try to answer it has no meaning. One has thus *to inquire into the appropriateness of the question.* In fact, truly original discoveries in science and in other fields have generally involved such inquiry into old questions, leading to a perception of their inappropriateness, and in this way allowing for the putting forth of new questions. To do this is often very difficult, as these presuppositions tend to be hidden very deep in the structure of our thought. (For example, Einstein saw that questions having to do with space and time and the particle nature of matter, as commonly accepted in the physics of his day, involved confused presuppositions that had to be dropped, and thus he was able to come to ask new questions leading to radically different notions on the subject.)

What, then, will be our question, as we engage in this inquiry into our language (and thought)? We begin with the fact of general fragmentation. We can ask in a preliminary way whether there are any features of the commonly used language which tend to sustain and propagate this fragmentation, as well as, perhaps, to reflect it. A cursory examination shows that a very important feature of this kind is the subject-verb-object structure of sentences, which is common to the grammar and syntax of modern languages. This structure implies that all action arises in a separate entity, the subject, and that, in cases described by a transitive verb, this action crosses over the space between them to another separate entity, the object. (If the verb is intransitive, as in 'he moves', the subject is still considered to be a separate entity but the activity is considered to be either a property of the subject or a reflexive action of the subject, e.g., in the sense that 'he moves' may be taken to mean 'he moves himself'.)

This is a pervasive structure, leading in the whole of life to a function of thought tending to divide things into separate entities, such entities being conceived of as essentially fixed and static in their nature. When this view is carried to its limit, one arrives at the prevailing scientific world view, in which everything is regarded as ultimately constituted out of a set of basic particles of fixed nature.

The subject-verb-object structure of language, along with its world view, tends to impose itself very strongly in our speech, even in those cases in which some attention would reveal its evident inappropriateness. For example, consider the sentence 'It is raining.' Where is the 'It' that would, according to the sentence, be 'the rainer that is doing the raining'? Clearly, it is more accurate to say: 'Rain is going on.' Similarly, we customarily say, 'One elementary particle acts on another', but, as indicated in the previous chapter, each particle is only an abstraction of a relatively invariant form of movement in the whole field of the universe. So it would be more appropriate to say, 'Elementary particles are on-going movements that are mutually dependent because ultimately they merge and interpenetrate.' However, the same sort of description holds also on the larger-scale level. Thus, instead of saying, 'An observer looks at an object', we can more appropriately say, 'Observation is going on, in an undivided movement involving those abstractions customarily called "the human being" and "the object he is looking at".'

These considerations on the overall implications of sentence structures suggest another question. Is it not possible for the syntax and grammatical form of language to be changed so as to give a basic role to the verb rather than to the noun? This would help to end the sort of fragmentation indicated above, for the verb describes actions and movements, which flow into each other and merge, without sharp separations or breaks. Moreover, since movements are in general always themselves changing, they have in them no permanent pattern of fixed form with

which separately existent things could be identified. Such an approach to language evidently fits in with the overall world view discussed in the previous chapter, in which movement is, in effect, taken as a primary notion, while apparently static and separately existent things are seen as relatively invariant states of continuing movement (e.g., recall the example of the vortex).

Now, in some ancient languages – for example, Hebrew – the verb was in fact taken as primary, in the sense described above. Thus, the root of almost all words in Hebrew was a certain verbal form, while adverbs, adjectives and nouns were obtained by modifying the verbal form with prefixes, suffixes, and in other ways. However, in modern Hebrew the actual usage is similar to that of English, in that the noun is in fact given a primary role in its meaning even though in the formal grammar all is still built from the verb as a root.

We have to try here, of course, to work with a structure in which the verb has a primary function, and to take this requirement seriously. That is to say, there is no point in using the verb in a formally primary role and to think in terms in which a set of separate and identifiable objects is taken to be what is basic. To say one thing and do another in this way is a form of confusion that would evidently simply add to the general fragmentation rather than help bring it to an end.

Suddenly to invent a whole new language implying a radically different structure of thought is, however, clearly not practicable. What can be done is provisionally and experimentally to introduce a *new mode* of language. Thus, we already have, for example, different moods of the verb, such as the indicative, the subjunctive, the imperative, and we develop skill in the use of language so that each of these moods functions, when it is required, without the need for conscious choice. Similarly, we will now consider a mode in which movement is to be taken as primary in our thinking and in which this notion will be incorporated into the language structure by allowing the verb rather than the noun

to play a primary role. As one develops such a mode and works with it for a while, one may obtain the necessary skill in using it, so that it will also come to function whenever it is required, without the need for conscious choice.

For the sake of convenience we shall give this mode a name, i.e. the *rheomode* ('rheo' is from a Greek verb, meaning 'to flow'). At least in the first instance the rheomode will be an experiment in the use of language, concerned mainly with trying to find out whether it is possible to create a new structure that is not so prone toward fragmentation as is the present one. Evidently, then, our inquiry will have to begin by emphasizing the role of language in shaping our overall world views as well as in expressing them more precisely in the form of general philosophical ideas. For as suggested in the previous chapter these world views and their general expressions (which contain tacit conclusions about everything, including nature, society, ourselves, our language, etc.) are now playing a key role in helping to originate and sustain fragmentation in every aspect of life. So we will start by using the rheomode mainly in an experimental way. As already pointed out, to do this implies giving a kind of careful attention to how thought and language actually work, which goes beyond a mere consideration of their content.

At least in the present inquiry the rheomode will be concerned mainly with questions having to do with the broad and deep implications of our overall world views which now tend to be raised largely in the study of philosophy, psychology, art, science and mathematics, but especially in the study of thought and language themselves. Of course, this sort of question can also be discussed in terms of our present language structure. While this structure is indeed dominated by the divisive form of subject-verb-object, it nevertheless contains a rich and complex variety of other forms, which are used largely *tacitly* and by *implication* (especially in poetry but more generally in all artistic modes of expression). However, the dominant form of

subject-verb-object tends continually to lead to fragmentation; and it is evident that the attempt to avoid this fragmentation by skilful use of other features of the language can work only in a limited way, for, by force of habit, we tend sooner or later, especially in broad questions concerning our overall world views, to fall unwittingly into the fragmentary mode of functioning implied by the basic structure. The reason for this is not only that the subject-verb-object form of the language is continually implying an inappropriate division between things but, even more, that the ordinary mode of language tends very strongly to take its own function for granted, and thus it leads us to concentrate almost exclusively on the content under discussion, so that little or no attention is left for the actual symbolic function of the language itself. As pointed out earlier, however, it is here that the primary tendency toward fragmentation originates. For because the ordinary mode of thought and language does not properly call attention to its own function, this latter seems to arise in a reality independent of thought and language, so that the divisions implied in the language structure are then projected, as if they were fragments, corresponding to actual breaks in 'what is'.

Such fragmentary perception may, however, give rise to the illusory impression that adequate attention is indeed already being given to the function of thought and language, and thus may lead to the false conclusion that there is in reality no serious difficulty of the sort described above. One may suppose, for example, that as the function of the world of nature is studied in physics, and that of society is studied in sociology, and that of the mind in psychology, so the function of language is given attention in linguistics. But of course such a notion would be appropriate only if all these fields were actually clearly separated and either constant or slowly changing in their natures, so that the results obtained in each field of specialization would be relevant in all situations and on all occasions in which they

might be applied. What we have been emphasizing, however, is that on questions of such broad and deep scope, this sort of separation is not appropriate and that in any case the crucial point is to give attention to the very language (and thought) that is being used, from moment to moment, in the inquiry into the function of language itself, as well as in any other form of inquiry in which one may engage. So it will not be adequate to isolate language as a particular field of inquiry and to regard it as a relatively static thing which changes only slowly (or not at all) as one goes into it.

It is clear, then, that in developing the rheomode, we will have to be especially aware of the need for language properly to call attention to its own function at the very moment in which this is taking place. In this way, we may not only be able to think more coherently about broad questions concerning our general world views, but we may also understand better how the ordinary mode of language functions, so that we may be able to use even this ordinary mode more coherently.

3 THE FORM OF THE RHEOMODE

We now go on to inquire in more detail into what may be a suitable form of expression for the rheomode.

As a first step in this inquiry, we may ask whether the rich and complex informal structure of the commonly used language does not contain, even if perhaps only in a rudimentary or germinal form, some feature that can satisfy the need, indicated above, to call attention to the real function of thought and language. If one looks into this question, one can see that there are such features. Indeed, in modern times, the most striking example is the use (and over-use) of the word ‘relevant’ (which may perhaps be understood as a kind of ‘groping’ for the attention-calling function that people almost unconsciously feel to be important).

The word ‘relevant’ derives from a verb ‘to relevate’, which has dropped out of common usage, whose meaning is ‘to lift’ (as in ‘elevate’). In essence, ‘to relevate’ means ‘to lift into attention’, so that the content thus lifted stands out ‘in relief’. When a content lifted into attention is coherent or fitting with the context of interest, i.e. when it has some bearing on the context of some relationship to it, then one says that this content is *relevant*; and, of course, when it does not fit in this way, it is said to be *irrelevant*.

As an example, we can take the writings of Lewis Carroll, which are full of humour arising from the use of the irrelevant. Thus, in *Through the Looking Glass*, there is a conversation between the Mad Hatter and the March Hare, containing the sentence: ‘This watch doesn’t run, even though I used the best butter.’ Such a sentence lifts into attention the irrelevant notion that the grade of butter has bearing on the running of watches – a notion that evidently does not fit the context of the actual structure of watches.

In making a statement about relevance, one is treating thought and language as realities, on the same level as the context in which they refer. In effect, one is, at the very moment in which the statement is made, looking or giving attention both to this context and to the overall function of thought and language, to see whether or not they fit each other. Thus, to see the relevance or irrelevance of a statement is primarily an act of perception of a very high order similar to that involved in seeing its truth or falsity. In one sense the question of relevance comes before that of truth, because to ask whether a statement is true or false presupposes that it is relevant (so that to try to assert the truth or falsity of an irrelevant statement is a form of confusion), but in a deeper sense the seeing of relevance or irrelevance is evidently an aspect of the perception of truth in its overall meaning.

Clearly, the act of apprehending relevance or irrelevance cannot be reduced to a technique or a method, determined by some

set of rules. Rather, this is an *art*, both in the sense of requiring creative perception and in the sense that this perception has to develop further in a kind of skill (as in the work of the artisan).

Thus it is not right, for example, to regard the division between relevance and irrelevance as a form of accumulated knowledge of properties belonging to statements (e.g., by saying that certain statements 'possess' relevance while others do not). Rather, in each case, the statement of relevance or irrelevance is communicating a perception taking place at the moment of expression, and is the individual context indicated in that moment. As the context in question changes, a statement that was initially relevant may thus cease to be so, or vice versa. Moreover, one cannot even say that a given statement is either relevant or irrelevant, and that this covers all the possibilities. Thus, in many cases, the total context may be such that one cannot clearly perceive whether the statement has bearing or not. This means that one has to learn more, and that the issue is, as it were, in a state of flux. So when relevance or irrelevance is communicated, one has to understand that this is not a hard and fast division between opposing categories but, rather, an expression of an ever-changing perception, in which it is possible, for the moment, to see a fit or non-fit between the content lifted into attention and the context to which it refers.

At present, the question of fitting or non-fitting is discussed through a language structure in which nouns are taken as basic (e.g., by saying 'this notion is relevant'). Such a structure does indeed formally imply a hard and fast division between relevance and irrelevance. So the form of the language is continually introducing a tendency toward fragmentation, even in those very features whose function is to call attention to the wholeness of language and the context in which it is being used.

As already stated we are, of course, often able to overcome this tendency toward fragmentation by using language in a freer, more informal, and 'poetic' way, that properly communicates

the truly fluid nature of the difference between relevance and irrelevance. Is it not possible, however, to do this more coherently and effectively by discussing the issue of relevance in terms of the rheomode, in which as suggested earlier, hard and fast divisions do not arise formally, because the verb, rather than the noun, is given a primary role?

To answer this question, we first note that the verb 'to relevate', from which the adjective 'relevant' is derived, ultimately comes from the root 'to levate' (whose meaning is, of course, 'to lift'). As a step in developing the rheomode, we then propose that the verb 'to levate' shall mean, 'The spontaneous and unrestricted act of lifting into attention any content whatsoever, which includes the lifting into attention of the question of whether this content fits a broader context or not, as well as that of lifting into attention the very function of *calling attention* which is initiated by the verb itself.' This implies an unrestricted breadth and depth of meaning, that is not fixed within static limits.

We then introduce the verb 'to re-levate'. This means: 'To lift a certain content into attention again, for a particular context, as indicated by thought and language.' Here, it has to be emphasized that 're' signifies 'again', i.e. on another occasion. It evidently implies *time* and similarity (as well as difference, since each occasion is not only similar but also different).

As pointed out earlier, it then requires an act of perception to see, in each case, whether the content thus 'lifted again' fits the observed context or not. In those cases in which this act of perception reveals a fit, we say: 'to re-levate is re-levant' (note that the use of the hyphen is essential here, and that the word should be pronounced with a break, as indicated by the hyphen). Of course, in those cases in which perception reveals non-fitting, we say 'to re-levate is irre-levant'.

We see, then, that adjectives have been built from the verb as a root form. Nouns also can be constructed in this way, and they

will signify not separate objects but, rather, *continuing states* of activity of the particular form indicated by the verbs. Thus, the noun 're-levation' means 'a continuing state of lifting a *given* content into attention'.

To go on with re-levation when to do so is irre-levant will, however, be called 'irre-levation'. In essence, irre-levation implies that there is not proper attention. When some content is irre-levant, it should normally sooner or later be dropped. If this does not happen, then one is, in some sense, not watchful or alert. Thus, irre-levation implies the need to give attention to the fact that there is not proper attention. *Attention to such failure of attention is of course the very act that ends irre-levation.*

Finally, we shall introduce the noun form 'levation', which signifies a sort of generalized and unrestricted totality of acts of lifting into attention (note that this differs from the 'to levate', which signifies a single spontaneous and unrestricted act of lifting into attention).

Clearly, the above way of using a structure of language form built from a root verb enables us to discuss what is commonly meant by 'relevance' in a way that is free of fragmentation, for we are no longer being led, by the form of the language, to consider something called relevance as if it were a separate and fixed quality. Even more important, we are not establishing a division between what the verb 'to levate' means and the actual function that takes place when we use this verb. That is to say, 'to levate' is not only to attend to the thought of lifting an unrestricted content into attention but it is also to engage in the very act of lifting such an unrestricted content into attention. The thought is thus not a mere abstraction, with no concrete perception to which it can refer. Rather, something is actually going on which fits the meaning of the word, and one can, at the very moment of using the word, perceive the fit between this meaning and what is going on. So the content of thought and its actual function are seen and felt as one, and thus one

understands what it can mean for fragmentation to cease, at its very origin.

Evidently, it is possible to generalize this way of building up language forms so that any verb may be taken as the root form. We shall then say that the rheomode is in essence characterized by this way of using a verb.

As an example, let us consider the Latin verb ‘videre’, meaning ‘to see’, which is used in English in such forms as ‘video’. We then introduce the root verbal form ‘to vidate’. This does not mean merely ‘to see’ in the visual sense, but we shall take it to refer to every aspect of perception including even the act of understanding, which is the apprehension of a totality, that includes sense perception, intellect, feeling, etc. (e.g., in the common language ‘to understand’ and ‘to see’ may be used interchangeably). So the verb ‘to vidate’ will call attention to a spontaneous and unrestricted act of perception of any sort whatsoever, including perception of whether what is seen fits or does not fit ‘what is’, as well as perception even of the very attention-calling function of the word itself. Thus, as happens with ‘to levate’, there is no division between the content (meaning) of this word and the total function to which it gives rise.

We then consider the verb ‘to re-vidate’, which means to perceive a given content *again*, as indicated by a word or thought. If this content is seen to fit the indicated context, then we say: ‘to re-vidate is re-vidant’. If it is seen not to fit, then of course we say: ‘to re-vidate is irre-vidant’ (which means, in ordinary usage, that this was a mistaken or illusory perception).

‘Re-vidation’ is then a continuing state of perceiving a certain content, while ‘irre-vidation’ is a continuing state of being caught in illusion or delusion, with regard to a certain content. Evidently (as with irre-levation) irre-vidation implies a failure of attention, and to attend to this failure of attention is to end irre-vidation.

Finally, the noun ‘vidation’ means an unrestricted and gener-

alized totality of acts of perception. Clearly, *vidation* is not to be sharply distinguished from *levation*. In an act of vidation, it is necessary to levate a content into attention, and in an act of levation, it is necessary to vidate this content. So the two movements of levation and vidation merge and interpenetrate. Each of these words merely emphasizes (i.e., re-levates) a certain aspect of movement in general. It will become evident that this will be true of all verbal roots in the rheomode. They all imply each other, and pass into each other. Thus, the rheomode will reveal a certain wholeness, that is not characteristic of the ordinary use of language (though it is there potentially, in the sense that if we start with movement as primary, then we have likewise to say that all movements shade into each other, to merge and interpenetrate).

Let us now go on to consider the verb 'to divide'. We shall take this to be a combination of the verb 'videre' and the prefix 'di', meaning 'separate'. So, 'to divide' is to be considered[1] as meaning 'to see as separate'.

We thus introduce the verb[2] 'to di-vidate'. This word calls attention to the spontaneous act of seeing things as separate, in any form whatsoever, including the act of seeing whether or not the perception fits 'what is', and even that of seeing how the attention-calling function of this word has a form of inherent division in it. With regard to this last point, we note that merely to consider the word 'di-vidate' makes it clear that this is different from the word 'vidate' from which it has been derived. So, to di-vidate implies not only a *content* (or meaning) of division but also that the very use of this word produces a function for which the notion of division is seen to provide a description that fits.

We now consider the verb 'to re-dividate', which means through thought and language to perceive a given content again in terms of a particular kind of separation or division. If to do this is seen to fit the indicated context, then we say that 'to

re-dividate is re-dividant'. If it is seen not to fit, we say that to 're-dividate is irre-dividant'.

Re-dividation is then a continuing state of seeing a certain content in the form of separation or division. Irre-dividation is a continuing state of seeing separation where, in the ordinary language, we would say that separation is irrelevant.

Irre-dividation is clearly essentially the same as fragmentation. So it becomes evident that fragmentation cannot possibly be a good thing, for it means not merely to see things as separate but to persist in doing this in a context in which this way of seeing does not fit. To go on indefinitely with irre-dividation is possible only through a failure of attention. Thus irre-dividation comes to an end in the very act of giving attention to this failure of attention.

Finally, of course, the noun 'dividation' means an unrestricted and generalized totality of acts of seeing things as separate. As has been indicated earlier, di-vidation implies a division in the attention-calling function of the word, in the sense that di-vidation is seen to be different from vidation. Nevertheless, this difference holds only in some limited context and is not to be taken as a fragmentation, or actual break, between the meanings and functions of the two words. Rather, their very forms indicate that dividation is a kind of vidation, indeed a special case of the latter. So ultimately, wholeness is primary, in the sense that these meanings and functions pass into each other to merge and interpenetrate. Division is thus seen to be a convenient means of giving a more articulated and detailed description to this whole, rather than a fragmentation of 'what is'.

The movement from division to one-ness of perception is through the action of *ordering*. (A more detailed discussion of this is given in chapter 5.) For example, a ruler may be divided into inches, but this set of divisions is introduced into our thinking only as a convenient means of expressing a *simple sequential order*, by

which we can communicate and understand something that has bearing on some whole object, which is measured with the aid of such a ruler.

This simple notion of a sequential order, expressed in terms of regular divisions in a line on a scale, helps to direct us in our constructional work, our travels and movements on the surface of the Earth and in space, and in a wide range of general practical and scientific activities. But, of course, more complex orders are possible, and these have to be expressed in terms of more subtle divisions and categories of thought, which are significant for more subtle forms of movement. Thus, there is the movement of growth, development and evolution of living beings, the movement of a symphony, the movement that is the essence of life itself, etc. These evidently have to be described in different ways that cannot generally be reduced to a description in terms of simple sequential orders.

Beyond all these orders is that of the movement of attention. This movement has to have an order that fits the order in that which is to be observed, or else we will miss seeing what is to be seen. For example, if we try to listen to a symphony while our attention is directed mainly to a sequential time order as indicated by a clock, we will fail to listen to the subtle orders that constitute the essential meaning of the music. Evidently, our ability to perceive and understand is limited by the freedom with which the ordering of attention can change, so as to fit the order that is to be observed.

It is clear, then, that in the understanding of the true meaning of the divisions of thought and language established for our convenience the notion of order plays a key role. To discuss this notion in the rheomode let us then introduce the verbal root form 'to ordinate'. This word calls attention to a spontaneous and unrestricted act of ordering of any sort whatsoever, including the ordering involved in seeing whether any particular order fits or does not fit some observed context, and even the ordering

which arises in the attention-calling function itself. So 'to ordinate' does not primarily mean 'to think about an order' but, rather, to engage in the very act of ordering attention, while attention is given also to one's thoughts about order. Once again, we see the wholeness of the meaning of a word and its overall function, which is an essential aspect of the rheomode.

'To re-ordinate' is then to call attention again to a given order, by means of language and thought. If this order is seen to fit that which is to be observed in the context under discussion, we say that 'to re-ordinate is re-ordinant'. If it is seen not to fit, we say that 'to re-ordinate is irre-ordinant' (e.g., as in the application of a linear grid to a complex maze of alleyways).

The noun 're-ordination' then describes a continuing state of calling attention to a certain order. A persistent state of re-ordination in an irre-ordinant context will then be called 'irre-ordination'. As happens with all other verbs, irre-ordination is possible only through a failure of attention, and comes to an end when attention is given to this failure of attention.

Finally, the noun 'ordination' means, of course, an unrestricted and generalized totality of acts of ordering. Evidently, ordination implies levation, vidation and di-vidation, and ultimately, all these latter imply ordination. Thus, to see whether a given content is re-levant, attention has to be suitably ordered to perceive this content; a suitable set of divisions or categories will have to be set up in thought, etc., etc.

Enough has been said of the rheomode at least to indicate in general how it works. At this point it may, however, be useful to display the overall structure of the rheomode by listing the words that have thus far been used:

Levate, re-levate, re-levant, irre-levant, levation, re-levation, irre-levation.

Vidate, re-vidate, re-vidant, irre-vidant, vidation, re-vidation, irre-vidation.

Di-vidate, re-dividate, re-dividant, irre-dividant, di-vidation, re-dividation, irre-dividation.
Ordinate, re-ordinate, re-ordinant, irre-ordinant, ordination, re-ordination, irre-ordination.

It should be noted that the rheomode involves, in the first instance, a new grammatical construction, in which verbs are used in a new way. However, what is further novel in it is that the syntax extends not only to the arrangement of words that may be regarded as already given, but also to a systematic set of rules for the formation of new words.

Of course, such word formation has always gone on in most languages (e.g. 'relevant' is built from the root 'levate' with the prefix 're' and the suffix 'ate' replaced by 'ant'), but this kind of construction has tended to arise mainly in a fortuitous way, probably as a result of the need to express various useful relationships. In any case, once the words have been put together the prevailing tendency has been to lose sight of the fact that this has happened and to regard each word as an 'elementary unit', so that the origin of such words in a construction is, in effect, treated as having no bearing on its meaning. In the rheomode, however, the word construction is not fortuitous, but plays a primary role in making possible a whole new mode of language, while the activity of word construction is continually being brought to our notice because the meanings depend in an essential way on the forms of such constructions.

It is perhaps useful here to make a kind of comparison with what has happened in the development of science. As seen in chapter 1 the prevailing scientific world view has generally been to suppose that, at bottom, everything is to be described in terms of the results of combinations of certain 'particle' units, considered to be basic. This attitude is evidently in accord with the prevailing tendency in the ordinary mode of language to treat words as 'elementary units' which, one supposes, can be

combined to express anything whatsoever that is capable of being said.

New words can, of course, be brought in to enrich discourse in the ordinary mode of language (just as new basic particles can be introduced in physics) but, in the rheomode, one has begun to go further and to treat the construction of words as not essentially different from the construction of phrases, sentences, paragraphs, etc. Thus, the 'atomistic' attitude to words has been dropped and instead our point of view is rather similar to that of field theory in physics, in which 'particles' are only convenient abstractions from the whole movement. Similarly, we may say that language is an undivided field of movement, involving sound, meaning, attention-calling, emotional and muscular reflexes, etc. It is somewhat arbitrary to give the present excessive significance to the breaks between words. Actually, the relationships between parts of a word may, in general, be of much the same sort as those between different words. So the word ceases to be taken as an 'indivisible atom of meaning' and instead it is seen as no more than a convenient marker in the whole movement of language, neither more nor less fundamental than the clause, the sentence, the paragraph, the system of paragraphs, etc. (This means that giving attention in this way to the components of words is not primarily an attitude of analysis but, rather, an approach that allows for the unrestricted flow of meaning.)

Some insight into the meaning of this change of attitude to words is given by considering language as a particular form of order. This is to say, language not only calls attention to order. It *is* an order of sounds, words, structures of words, nuances of phrase and gesture, etc. Evidently, the meaning of a communication through language depends, in an essential way, on the order that language *is*. This order is more like that of a symphony in which each aspect and movement has to be understood in the light of its relationship to the whole, rather than like the simple

sequential order of a clock or a ruler; and since (as has been pointed out here) the order of sounds *within* a word is an inseparable aspect of the whole meaning, we can develop rules of grammar and syntax that use this order in a systematic way to enrich and enhance the possibilities of the language for communication and for thinking.

4 TRUTH AND FACT IN THE RHEOMODE

In the ordinary mode of language, truth is taken as a noun, which thus stands for something that can be grasped once and for all or which can at least be approached, step by step. Or else, the possibility of being either true or false may be taken as a *property* of statements. However, as indicated earlier, truth and falsity have actually, like relevance and irrelevance, to be seen from moment to moment, in an act of perception of a very high order. Thus, the truth or falsity *in content* of a statement is apprehended by observing whether or not this content fits a broader context which is indicated either in the statement itself or by some action or gesture (such as pointing) that goes together with the statement. Moreover, when we come to statements about world views, which have to do with 'the totality of all that is', there is no clearly definable context to which they can refer and so we have to emphasize *truth in function*, i.e. the possibility of free movement and change in our general notions of reality as a whole, so as to allow for a continual fitting to new experience, going beyond the limits of fitting of older notions of this kind. (See chapters 3 and 7 for a further discussion of this.)

It is clear, then, that the ordinary mode of language is very unsuitable for discussing questions of truth and falsity, because it tends to treat each truth as a separate fragment that is essentially fixed and static in its nature. It will thus be interesting to experiment with the use of the rheomode, to see in what way

this can allow us to discuss the question of truth more fittingly and coherently.

We shall begin by considering the Latin 'verus', meaning 'true'. So we shall introduce the root verbal form 'to verrate'. (The double 'r' is brought in here to avoid a certain confusion of a kind that will be evident as we proceed.) This word calls attention, in the manner discussed in the previous section, to a spontaneous and unrestricted act of seeing truth in any form whatsoever, including the act of seeing whether this perception fits or does not fit that which is perceived actually to happen in the apprehension of truth, as well as seeing the truth in the attention-calling function of the word itself. So, 'to verrate' is to be in the act of perceiving truth, as well as to be attending to what truth means.

To re-verrate, then, is to call attention again, by means of thought and language, to a particular truth in a given context. If this is seen to fit what is to be observed in this context, we say that *to re-verrate is re-verrant*, and if it is seen not to fit, we say that *to re-verrate is irre-verrant* (i.e. a particular truth ceases to be valid when repeated and extended into a context that is beyond its proper limits).

We see, then, that the question of truth is no longer being discussed in terms of separate and essentially static fragments. Rather, our attention is called to the general act of *verration*, and to its continuation in a particular context as *re-verration* and *irre-verration*. (Irre-verration, i.e. the persistent holding to a truth beyond its proper limits, has evidently been one of the major sources of illusion and delusion throughout the whole of history and in every phase of life.) Verration is to be seen as a flowing movement, which merges and interpenetrates with levation, vidation, di-vidation, ordination, and indeed with all the other movements that will be indicated in the subsequent development of the rheomode.

Now, when we discuss truth in the ordinary mode, we are

inevitably brought to consider what is to be meant by *the fact*. Thus, in some sense, to say: 'This is a fact' implies that the content of the statement in question is true. However, the root meaning of the word 'fact' is 'that which has been made' (e.g., as in 'manufacture'). This meaning does have bearing here because, as is evident, in some sense we actually do 'make' the fact: for this fact depends not only on the context that is being observed and on our immediate perception, it also depends on how our perceptions are shaped by our thoughts, as well as on what we *do*, to test our conclusions, and to apply them in practical activities.

Let us now go on to experiment with the use of the rheomode, to see where this leads when we consider what is meant by 'the fact'. We thus introduce the root verb 'to factate', meaning a spontaneous and unrestricted attention to consciously directed human activity in *making* or *doing any sort of thing whatsoever*[3] (and this, of course, includes the 'making' or 'doing' of the attention-calling function of the word itself). To re-factate is, then, through thought and language, to call attention again to such an activity of 'making' or 'doing' in a particular context. If this activity is seen to fit within the context (i.e. if what we are doing 'works') then we say 'to re-factate is re-factant' and if it is seen not to fit, we say 'to re-factate is irre-factant'.

Clearly, a great deal of what is ordinarily meant by the truth or falsity of a statement is contained in the implication of the words 're-factant' and 'irre-factant'. Thus it is evident that when true notions are applied in practice, they will generally lead to our doing something that 'works', while false notions will lead to activities that 'do not work'.

Of course, we have to be careful here not to identify truth as nothing more than 'that which works' since, as has been seen, truth is a whole movement, going far beyond the limited domain of our consciously directed functional activities. So, although the statement 're-verration is re-factant' is correct as far

as it goes, it is important to keep in mind that this calls attention only to a certain aspect of what is to be meant by truth. Indeed, it does not even cover all that is meant by *fact*. Far more is involved in establishing the fact than merely to observe that our knowledge is re-factant, i.e. that it has generally led us successfully to achieve the goals that were originally projected in thought. In addition, the fact has to be *tested* continually, through further observation and experience. The primary aim of such testing is not the production of some desired result or end but, rather, it is to see whether the fact will 'stand up', even when the context to which it refers is observed again and again, either in essentially the same way as before, or in new ways that may have bearing on this context. In science, such testing is carried out through experiments, which not only have to be reproducible but which also have to fit in with 'cross-checks' provided by other experiments that are significant in the context of interest. More generally, experience as a whole is always providing a similar sort of test, provided that we are alert and observant to see what it actually indicates.

When we say 'this is a fact' we then imply a certain ability of the fact to 'stand up to' a wide range of different kinds of testing. Thus, the fact is *established*, i.e. it is shown to be *stable*, in the sense that it is not liable to collapse, or to be nullified at any moment, in a subsequent observation of the general sort that has already been carried out. Of course, this stability is only relative, because the fact is always being tested again and again, both in ways that are familiar and in new ways that are continually being explored. So it may be refined, modified, and even radically changed, through further observation, experiment and experience. But in order to be a 'real fact', it evidently has, in this way, to remain *constantly* valid, at least in certain contexts or over a certain period of time.

To lay the ground for discussing this aspect of the fact in the rheomode, we first note that the word 'constant' is derived from

a now obsolete verb 'to constate', which means 'to establish', 'to ascertain', or 'to confirm'. This meaning is made even more evident by considering the Latin root 'constare' ('stare' meaning 'to stand' and 'con' meaning 'together'). Thus, we can say that in the activity of testing, we 'constate' the fact; so that is established and 'stands together firmly', as a coherent body, which is able in a certain relative sense, to 'stand up' to being put to the test. Thus, within certain limits, the fact remains *con-stant*.

Actually, the very closely related word 'constater' is used in modern French, in much the sense that has been indicated above. In a certain way, it covers what is meant here better than 'constate' because it is derived from the Latin 'constat' which is the past participle of 'constare', and thus its root meaning would be 'to have stood together'. This fits together quite well with 'fact' or 'that which *has* been made'.

To consider these questions in the rheomode, we then introduce the root verb 'to con-statate'. This means 'to give spontaneous and unrestricted attention to how any sort of action or movement whatsoever is established in a relatively constant form that stands together relatively stably, including the action of establishing a body of fact that stands together in this way, and even the action of this very word in helping to establish the fact about the function of language itself'.

To re-constatate is then by means of word and thought, to call attention again to a particular action or movement of this kind in a given context. If this latter is seen to fit within the context in question, we say: 'to re-constatate is re-constatant', and if it is seen not to fit, we say: 'to re-constatate is irre-constatant' (e.g. the fact as it had previously been established is not found factually to 'stand up' to further observation and experience).

The noun form 're-constation' then signifies a particular kind of continuing *state* of action or movement in a given context that 'stands together' in a relatively constant way, whether this be our own action in establishing a fact, or any other kind of

movement that can be described as established or stable in form. It may thus, in the first instance, refer to the possibility of confirming again and again, in a series of acts of observation or experimentation, that 'the fact still stands'; or it may refer to a certain continuing state of movement (or of affairs) which 'still stands' in an overall reality including and going beyond our acts of observation and experimentation. Finally it may refer to the verbal activity of making a statement (i.e. *state*-ment) by which what one person re-constatates can be communicated, to be re-constatated by other people. That is to say, a re-constatation is, in ordinary use of language, 'an established fact' or 'the actual state of movement or of affairs that the fact is about' or 'the verbal statement of the fact'. So we do not make a sharp distinction between the act of perception and experimentation, the action of that which we perceive and of which we experiment, and the activity of communicating verbally about what we have observed and done. All of these are regarded as sides or aspects of an unbroken and undivided whole movement, which are closely related, both in function and in content (and thus we do not fall into a fragmentary division between our 'inward' mental activities and their 'outward' function).

Evidently, this use of the rheomode fits very well with the world view in which apparently static things are likewise seen as abstractions of relatively invariant aspects from an unbroken and undivided whole movement. However, it goes further in implying that the fact about such things is itself abstracted as just that relatively constant aspect of the whole movement appearing in perception and experienced in action, which 'stands together' in a continuing state, and which is thus suitable for communication in the form of a statement.

5 THE RHEOMODE AND ITS IMPLICATIONS FOR OUR OVERALL WORLD VIEW

In seeing (as pointed out in the previous section) that the rheomode does not allow us to discuss the observed fact in terms of separately existent things of an essentially static nature, we are led to note that the use of the rheomode has implications for our general world view. Indeed, as has already been brought out to some extent, every language form carries a kind of dominant or prevailing world view, which tends to function in our thinking and in our perception whenever it is used, so that to give a clear expression of a world view contrary to the one implied in the primary structure of a language is usually very difficult. It is therefore necessary in the study of any general language form to give serious and sustained attention to its world view, both in content and in function.

As indicated earlier, one of the major defects of the ordinary mode of using language is just its general implication that it is not restricting the world view in any way at all, and that in any case questions of world view have to do only with 'one's own particular philosophy', rather than with the content and function of our language, or with the way in which we tend to experience the overall reality in which we live. By thus making us believe that our world view is only a relatively unimportant matter, perhaps involving mainly one's personal taste or choice, the ordinary mode of language leads us to fail to give attention to the actual function of the divisive world view that pervades this mode, so that the automatic and habitual operation of our thought and language is then able to project these divisions (in the manner discussed earlier) as if they were actual fragmentary breaks in the nature of 'what is'. It is thus essential to be aware of the world view implied in each form of language, and to be watchful and alert, to be ready to see when this world view ceases to fit actual

observation and experience, as these are extended beyond certain limits.

It has become evident in this chapter that the world view implied in the rheomode is in essence that described in the first chapter, which is expressed by saying that *all* is an unbroken and undivided whole movement, and that each 'thing' is abstracted only as a relatively invariant side or aspect of this movement. It is clear, therefore, that the rheomode implies a world view quite different from that of the usual language structure. More specifically, we see that the mere act of seriously considering such a new mode of language and observing how it works can help draw our attention to the way in which our ordinary language structure puts strong and subtle pressures on us to hold to a fragmentary world view. Whether it would be useful to go further, however, and to try to introduce the rheomode into active usage, it is not possible to say at present, though perhaps some such development may eventually be found to be helpful.

3

REALITY AND KNOWLEDGE CONSIDERED AS PROCESS

1 INTRODUCTION

The notion that reality is to be understood as process is an ancient one, going back at least to Heraclitus, who said that everything flows. In more modern times, Whitehead[1] was the first to give this notion a systematic and extensive development. In this chapter I shall discuss the question of the relationship between reality and knowledge from such a point of view. However, while my explicit starting point is generally similar to that of Whitehead, some implications will emerge that may be significantly different from those of his work.

I regard the essence of the notion of process as given by the statement: Not only is everything changing, but all *is* flux. That is to say, *what is* is the process of becoming itself, while all objects, events, entities, conditions, structures, etc., are forms that can be abstracted from this process.

The best image of process is perhaps that of the flowing

stream, whose substance is never the same. On this stream, one may see an ever-changing pattern of vortices, ripples, waves, splashes, etc., which evidently have no independent existence as such. Rather, they are abstracted from the flowing movement, arising and vanishing in the total process of the flow. Such transitory subsistence as may be possessed by these abstracted forms implies only a relative independence or autonomy of behaviour, rather than absolutely independent existence as ultimate substances. (See chapter 1 for a further discussion of this notion.)

Of course, modern physics states that actual streams (e.g., of water) are composed of atoms, which are in turn composed of 'elementary particles', such as electrons, protons, neutrons, etc. For a long time it was thought that these latter are the 'ultimate substance' of the whole of reality, and that all flowing movements, such as those of streams, must reduce to forms abstracted from the motions through space of collections of interacting particles. However, it has been found that even the 'elementary particles' can be created, annihilated and transformed, and this indicates that not even these can be ultimate substances but, rather, that they too are relatively constant forms, abstracted from some deeper level of movement.

One may suppose that this deeper level of movement may be analysable into yet finer particles which will perhaps turn out to be the ultimate substance of the whole of reality. However, the notion that all is flux, into which we are inquiring here, denies such a supposition. Rather, it implies that any describable event, object, entity, etc., is an abstraction from an unknown and undefinable totality of flowing movement. This means that no matter how far our knowledge of the laws of physics may go, the content of these laws will still deal with such abstractions, having only a relative independence of existence and independence of behaviour. So one will not be led to suppose that *all* properties of collections of objects, events, etc., will have to be explainable

in terms of some knowable set of ultimate substances. At any stage, further properties of such collections may arise, whose ultimate ground is to be regarded as the unknown totality of the universal flux.

Having discussed what the notion of process implies concerning the nature of reality, let us now consider how this notion should bear on the nature of knowledge. Clearly, to be consistent, one has to say that knowledge, too, is a process, an abstraction from the one total flux, which latter is therefore the ground both of reality and of knowledge of this reality. Of course, one may fairly readily verbalize such a notion, but in actual fact it is very difficult not to fall into the almost universal tendency to treat our knowledge as a set of basically fixed truths, and thus not of the nature of process (e.g., one may admit that knowledge is always changing but say that it is accumulative, thus implying that its basic elements are permanent truths which we have to discover). Indeed, even to assert any absolutely invariant element of knowledge (such as 'all is flux') is to establish in the field of knowledge something that is permanent; but if *all* is flux, then every part of knowledge must have its being as an abstracted form in the process of becoming, so that there can be no absolutely invariant elements of knowledge.

Is it possible to be free of this contradiction, in the sense that one could understand not only reality, but also *all* knowledge, as grounded in the flowing movement? Or must one necessarily regard *some* elements of knowledge (e.g., those concerning the nature of process) as absolute truths, beyond the flux of process? It is to this question that we shall address ourselves in this chapter.

2 THOUGHT AND INTELLIGENCE

To inquire into the question of how knowledge is to be understood as process, we first note that all knowledge is produced,

displayed, communicated, transformed, and applied in *thought*. Thought, considered in its *movement of becoming* (and not merely in its content of relatively well-defined images and ideas) *is* indeed the process in which knowledge has its actual and concrete existence. (This has been discussed in the Introduction.)

What is the process of thought? Thought is, in essence, the active response of memory in every phase of life. We include in thought the intellectual, emotional, sensuous, muscular and physical responses of memory. These are all aspects of one indissoluble process. To treat them separately makes for fragmentation and confusion. All these are one process of response of memory to each actual situation, which response in turn leads to a further contribution to memory, thus conditioning the next thought.

One of the earliest and most primitive forms of thought is, for example, just the memory of pleasure or pain, in conjunction with a visual, auditory, or olfactory image that may be evoked by an object or a situation. It is common in our culture to regard memories involving image content as separate from those involving feeling. It is clear, however, that the *whole meaning* of such a memory is just the conjunction of the image with its feeling, which (along with the intellectual content and the physical reaction) constitutes the totality of the judgment as to whether what is remembered is good or bad, desirable or not, etc.

It is clear that thought, considered in this way as the response of memory, is basically mechanical in its order of operation. Either it is a repetition of some previously existent structure drawn from memory, or else it is some combination arrangement and organization of these memories into further structures of ideas and concepts, categories, etc. These combinations may possess a certain kind of novelty resulting from the fortuitous interplay of elements of memory, but it is clear that such novelty is still essentially mechanical (like the new combinations appearing in a kaleidoscope).

There is in this mechanical process no inherent reason why the thoughts that arise should be relevant or fitting to the actual situation that evokes them. The perception of whether or not any particular thoughts are relevant or fitting requires the operation of an energy that is not mechanical, an energy that we shall call *intelligence*. This latter is able to perceive a new order or a new structure, that is not just a modification of what is already known or present in memory. For example, one may be working on a puzzling problem for a long time. Suddenly, in a flash of understanding, one may see the irrelevance of one's whole way of thinking about the problem, along with a different approach in which all the elements fit in a new order and in a new structure. Clearly, such a flash is essentially an *act of perception*, rather than a process of thought (a similar notion was discussed in chapter 1), though later it may be expressed in thought. What is involved in this act is *perception through the mind* of abstract orders and relationships such as identity and difference, separation and connection, necessity and contingency, cause and effect, etc.

We have thus put together all the basically mechanical and conditioned responses of memory under one word or symbol, i.e. thought, and we have distinguished this from the fresh, original and unconditioned response of intelligence (or intelligent perception) in which something new may arise. At this point, however, one may ask: 'How can one know that such an unconditioned response is at all possible?' This is a vast question, which cannot be discussed fully here. However, it can be pointed out here that at least implicitly everybody does in fact accept the notion that intelligence is not conditioned (and, indeed, that one cannot consistently do otherwise).

Consider, for example, an attempt to assert that all of man's actions are conditioned and mechanical. Typically, such a view has taken one of two forms: Either it is said that man is basically a product of his hereditary constitution, or else that he is determined entirely by environmental factors. However, one could ask

of the man who believed in hereditary determination whether his own statement asserting this belief was nothing but the product of his heredity. In other words, is he compelled by his genetic structure to make such an utterance? Similarly, one may ask of the man who believes in environmental determination, whether the assertion of such a belief is nothing but the spouting forth of words in patterns to which he was conditioned by his environment. Evidently, in both cases (as well as in the case of one who asserted that man is completely conditioned by heredity *plus* environment) the answer would have to be in the negative, for otherwise the speakers would be denying the very possibility that what they said could have meaning. Indeed, it is necessarily implied, in any statement, that the speaker is capable of talking from intelligent perception, which is in turn capable of a *truth* that is not merely the result of a mechanism based on meaning or skills acquired in the past. So we see that no one can avoid implying, by his mode of communication, that he accepts at least the possibility of that free, unconditioned perception that we have called intelligence.

Now, there is a great deal of evidence indicating that thought is basically a material process. For example, it has been observed in a wide variety of contexts that thought is inseparable from electrical and chemical activity in the brain and nervous system, and from concomitant tensions and movements of muscles. Would one then say that intelligence is a similar process, though perhaps of a more subtle nature?

It is implied in the view we are suggesting here that this is not so. If intelligence is to be an unconditioned act of perception, its ground cannot be in structures such as cells, molecules, atoms, elementary particles, etc. Ultimately, anything that is determined by the laws of such structures must be in the field of what can be known, i.e. stored up in memory, and thus it will have to have the mechanical nature of anything that can be assimilated in the basically mechanical character of the process of thought. The

actual operation of intelligence is thus beyond the possibility of being determined or conditioned by factors that can be included in any knowable law. So, we see that the ground of intelligence must be in the undetermined and unknown flux, that is also the ground of all definable forms of matter. Intelligence is thus not deducible or explainable on the basis of any branch of knowledge (e.g., physics or biology). Its origin is deeper and more inward than any knowable order that could describe it. (Indeed, it has to comprehend the very order of definable forms of matter through which we would hope to comprehend intelligence.)

What, then, is the relationship of intelligence to thought? Briefly, one can say that when thought functions on its own, it is mechanical and not intelligent, because it imposes its own generally irrelevant and unsuitable order drawn from memory. Thought is, however, capable of responding, not only from memory but also to the unconditioned perception of intelligence that can see, in each case, whether or not a particular line of thought is relevant and fitting.

One may perhaps usefully consider here the image of a radio receiver. When the output of the receiver 'feeds back' into the input, the receiver operates on its own, to produce mainly irrelevant and meaningless noise, but when it is sensitive to the signal on the radio wave, its own order of inner movement of electric currents (transformed into sound waves) is parallel to the order in the signal and thus the receiver serves to bring a meaningful order originating beyond the level of its own structure into movements on the level of its own structure. One might then suggest that in intelligent perception, the brain and nervous system respond directly to an order in the universal and unknown flux that cannot be reduced to anything that could be defined in terms of knowable structures.

Intelligence and material process have thus a single origin, which is ultimately the unknown totality of the universal flux. In a certain sense, this implies that what have been commonly

called mind and matter are abstractions from the universal flux, and that both are to be regarded as different and relatively autonomous orders within the one whole movement. (This notion is discussed further in chapter 7.) It is thought responding to intelligent perception which is capable of bringing about an overall harmony or fitting between mind and matter.

3 THE THING AND THE THOUGHT

Given that thought is a material process that may be relevant in some more general context when it moves in parallel with intelligent perception, one is now led to inquire into the relationship between thought and reality. Thus, it is commonly believed that the content of thought is in some kind of reflective correspondence with 'real things', perhaps being a kind of copy, or image, or imitation of things, perhaps a kind of 'map' of things, or perhaps (along lines similar to those suggested by Plato) a grasp of the essential and innermost forms of things.

Are any of these views correct? Or is the question itself not in need of further clarification? For it presupposes that we know what is meant by the 'real thing' and by the distinction between reality and thought. But this is just what is not properly understood (e.g., even the relatively sophisticated Kantian notion of 'thing in itself' is just as unclear as the naïve idea of 'real thing').

We may perhaps obtain a clue here by going into the origins of words such as 'thing' and 'reality'. The study of origins of words may be regarded as a sort of archaeology of our thought process, in the sense that the traces of earlier forms of thought can be found by observations made in this field. As in the study of human society, clues coming from archaeological inquiries can often help us to understand the present situation better.

Now the word 'thing' goes back to various old English words[2] whose significance includes 'object', 'action', 'event', 'condition', 'meeting', and is related to words meaning 'to determine',

'to settle', and, perhaps, to 'time' or 'season'. The original meaning might thus have been 'something occurring at a given time, or under certain conditions'. (Compare to the German 'bedingen', meaning 'to make conditions', or 'to determine', which could perhaps be rendered into English as 'to bething'.) All these meanings indicate that the word 'thing' arose as a highly generalized indication of any form of existence, transitory or permanent, that is limited or determined by conditions.

What, then, is the origin of the word 'reality'? This comes from the Latin 'res', which means 'thing'. To be real is to be a 'thing'. 'Reality' in its earlier meaning would then signify 'thinghood in general' or 'the quality of being a thing'.

It is particularly interesting that 'res' comes from the verb 'reri', meaning 'to think', so that literally, 'res' is 'what is thought about'. It is of course implicit that what is thought about has an existence that is independent of the process of thought, or in other words, that while we create and sustain an idea as a mental image by thinking about it, we do not create and sustain a 'real thing' in this way. Nevertheless, the 'real thing' is limited by conditions that can be expressed in terms of thought. Of course, the real thing has more in it than can ever be implied by the content of our thought about it, as can always be revealed by further observations. Moreover, our thought is not in general completely correct, so that the real thing may be expected ultimately to show behaviour or properties contradicting some of the implications of our thought about it. These are, indeed, among the main ways in which the real thing can demonstrate its basic independence from thought. The main indication of the relationship between thing and thought is, then, that when one thinks correctly about a certain thing, this thought can, at least up to a point, guide one's actions in relationship to that thing to produce an overall situation that is harmonious and free of contradiction and confusion.

If the thing and the thought about it have their ground in the

one undefinable and unknown totality of flux, then the attempt to explain their relationship by supposing that the thought is in reflective correspondence with the thing has no meaning, for both thought and thing are forms abstracted from the total process. The reason why these forms are related could only be in the ground from which they arise, but there can be no way of discussing reflective correspondence in this ground, because reflective correspondence implies knowledge, while the ground is beyond what can be assimilated in the content of knowledge.

Does this mean that there can be no further insight into the relationship of thing and thought? We suggest that such further insight is in fact possible but that it requires looking at the question in a different way. To show the orientation involved in this way, we may consider as an analogy the well-known dance of the bees, in which one bee is able to indicate the location of honey-bearing flowers to other bees. This dance is probably not to be understood as producing in the 'minds' of the bees a form of knowledge in reflective correspondence with the flowers. Rather, it is an activity which, when properly carried out, acts as a pointer or indicator, disposing the bees to an order of action that will generally lead them to the honey. This activity is not separate from the rest of what is involved in collecting the honey. It flows and merges into the next step in an unbroken process. So one may propose for consideration the notion that thought is a sort of 'dance of the mind' which functions indicatively, and which, when properly carried out, flows and merges into an harmonious and orderly sort of overall process in life as a whole.

In practical affairs, it is fairly clear what this harmony and order mean (e.g., the community will be successful in producing food, clothing, shelter, healthy conditions of life, etc.), but man also engages in thought going beyond the immediately practical. For example, since time immemorial he has sought to understand the origin of all things and their general order and nature,

in religious thought, in philosophy, and in science. This may be called thought that has 'the totality of all that is' as its content (for example, the attempt to comprehend the nature of reality as a whole). What we are proposing here is that such comprehension of the totality is not a reflective correspondence between 'thought' and 'reality as a whole'. Rather, it is to be considered as an art form, like poetry, which may dispose us toward order and harmony in the overall 'dance of the mind' (and thus in the general functioning of the brain and nervous system). This point has been made earlier, in the Introduction.

What is required here, then, is not an *explanation* that would give us some knowledge of the relationship of thought and thing, or of thought and 'reality as a whole'. Rather, what is needed is an *act of understanding*; in which we see the totality as an actual process that, when carried out properly, tends to bring about an harmonious and orderly overall action, incorporating both thought and what is thought about in a single movement, in which analysis into separate parts (e.g., thought and thing) has no meaning.

4 THOUGHT AND NON-THOUGHT

While it is thus clear that *ultimately* thought and thing cannot properly be analysed as separately existent, it is also evident that in man's immediate experience some such analysis and separation has to be made, at least provisionally, or as a point of departure. Indeed, the distinction between what is real and what is mere thought and therefore imaginary or illusory is absolutely necessary, not only for success in practical affairs but also if we are in the long run even to maintain our sanity.

It is useful here to consider how such a distinction may have arisen. It is well known,[3] for example, that a young child often finds it difficult to distinguish the contents of his thought from real things (e.g., he may imagine that these contents are visible to

others, as they are visible to him, and he may be afraid of what others call 'imaginary dangers'). So while he tends to begin the process of thinking naïvely (i.e. without being explicitly conscious that he *is* thinking), at some stage he becomes consciously aware of the process of thought, when he realizes that some of the 'things' that he seems to perceive are actually 'only thoughts' and therefore 'no things' (or nothing) while others are 'real' (or something).

Primitive man must often have been in a similar situation. As he began to build up the scope of his practical technical thought in his dealings with things, such thought images became more intense and more frequent. In order to establish a proper balance and harmony in the whole of his life he probably felt the need to develop his thought about totality in a similar way. In this latter kind of thought, the distinction between thought and thing is particularly liable to become confused. Thus, as men began to think of the forces of nature and of gods, and as artists made realistic images of animals and gods, sensed as possessing magical or transcendent powers, man was led to engage in a kind of thought without any clear physical referent that was so intense, so unremittant, and so 'realistic' that he could no longer maintain a clear distinction between mental image and reality. Such experiences must eventually have given rise to a deeply felt urge to clear up this distinction (expressed in questions such as 'Who am I?', 'What is my nature?', 'What is the true relationship of man, nature and the gods?', etc.), for to remain permanently confused about what is real and what is not, is a state that man must ultimately find to be intolerable, since it not only makes impossible a rational approach to practical problems but it also robs life of all meaning.

It is clear, then, that sooner or later, man in his overall process of thought would engage in systematic attempts to clear up this distinction. One can see that at some stage it has to be felt in this process that it is not enough to know how to distinguish

particular thoughts from particular things. Rather, it is necessary to understand the distinction universally. Perhaps, then, the primitive man or the young child may have a flash of insight in which he sees, probably without explicitly verbalizing it, that *thought as a whole* has to be distinguished from *the whole of what is not thought*. This may be put more succinctly as the distinction between thought and non-thought, and abbreviated further to T and NT. The line of reasoning implicit in such a distinction is:

> T is not NT (thought and non-thought are different and mutually exclusive).
>
> All is either T or NT (thought and non-thought cover the whole of what can exist).

In a certain sense, true thinking begins with this distinction. Before it is made, thinking may take place but, as indicated earlier, there can be no full consciousness that thinking is what is taking place. So, thought proper begins in this way with thought, conscious of itself through its distinguishing itself from non-thought.

Moreover, this step in which thought proper begins is perhaps man's first thought with the totality as its content. And we can see how deeply such thought is embedded in the consciousness of all mankind, and how it arises very early as a necessary stage in the attempt of thought to bring sanity and order to its 'dance'.

This mode of thought is further developed and articulated by trying to discover various distinguishing characteristics or qualities that belong to thought and to non-thought. Thus, non-thought is commonly identified with reality, in the sense of thinghood. As indicated earlier, real things are recognized mainly by their independence of how we think of them. Further characteristic distinctions are that real things may be palpable, stable, resistant to attempts to change them, sources of independent activity throughout the whole of reality. On the

other hand, thoughts may be regarded as mere 'mental stuff', impalpable, transient, easily changed, and not capable of initiating independent lines of activity outside of themselves, etc.

Ultimately, however, such a fixed distinction between thought and non-thought cannot be maintained, for one can see that thought is a real activity, which has to be grounded in a broader totality of real movement and action that overlaps and includes thought.

Thus, as has already been pointed out, thought is a material process whose content is the total response of memory, including feelings, muscular reactions and even physical sensations, that merge with and flow out of the whole response. Indeed, all man-made features of our general environment are, in this sense, extensions of the process of thought, for their shapes, forms, and general orders of movement originate basically in thought, and are incorporated within this environment, in the activity of human work, which is guided by such thought. Vice versa, everything in the general environment has, either naturally or through human activity, a shape, form, and mode of movement, the content of which 'flows in' through perception, giving rise to sense impressions which leave memory traces and thus contribute to the basis of further thought.

In this whole movement, content that was originally in memory continually passes into and becomes an integral feature of the environment, whole content that was originally in the environment passes into and becomes an integral feature of memory, so that (as pointed out earlier) the two participate in a single total process, in which analysis into separate parts (e.g. thought and thing) has ultimately no meaning. Such a process, in which thought (i.e. the response of memory) and the general environment are indissolubly linked, is evidently of the nature of a *cycle*, as illustrated symbolically in figure 3.1 (though of course the cycle should be regarded more accurately as always

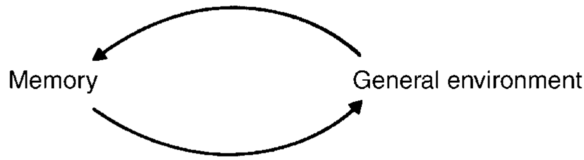

Figure 3.1

opening out into a spiral). This cyclical (or spiral) movement, in which thought has its full actual and concrete existence, includes also the communication of thoughts between people (who are parts of each other's environment) and it goes indefinitely far into the past. Thus, at no stage can we properly say that the *overall process* of thought begins or ends. Rather, it has to be seen as one unbroken totality of movement, not belonging to any particular person, place, time, or group of people. Through the consideration of the physical nature of the response of memory in reactions of nerves, feelings, muscular motions, etc., and through the consideration of the merging of these responses with the general environment in the overall cyclical process described above, we see then that thought *is* non-thought (T *is* NT).

Vice versa, however, we can see also that non-thought *is* thought (NT *is* T). Thus, 'reality' *actually is* a word with a certain implied thought content. To be sure, this may be said of any term in our language, but, as has been seen, such terms may generally indicate real things, which we can in principle perceive. There is no way, however, to look at reality as if it were some sort of 'thing', in order to test whether our idea fits or does not fit this 'thing called reality'. We have indeed already suggested in this connection that the term 'reality' indicates an unknown and undefinable totality of flux that is the ground of all things and of the process of thought itself, as well as of the movement of intelligent perception. But this does not basically alter the question, for if reality is thus unknown and unknowable, how can we

be certain that it is there at all? The answer is, of course, that we can't be certain.

Nevertheless, it does not follow from this that 'reality' is a meaningless word, for, as we have already seen, the mind in its 'dance of thought' can in the long run move in an orderly and sane manner only if the 'form of the dance' includes some sort of distinction between thought and non-thought (i.e., reality). We have also seen, however, that this distinction has to be made in the ever-changing flux of process in which thought passes into non-thought while non-thought passes into thought, so that it cannot be regarded as fixed. Such a non-fixed distinction evidently requires the free movement of intelligent perception, which can, on each occasion, discern what content originates in thought and what content originates in a reality that is independent of thought.

It is clear, then, that the term 'reality' (which in this context means 'reality as a whole') is not properly to be regarded as part of the content of thought. Or, to put this in another way, we may say that *reality is no thing* and that it is also not the *totality of all things* (i.e., we are not to identify 'reality' with 'everything'). Since the word 'thing' signifies a conditioned form of existence, this means that 'reality as a whole' is also not to be regarded as conditioned. (Indeed, it could not consistently be so regarded, because the very term 'reality as a whole' implies that it contains all factors that could condition it and on which it could depend.) So any notion of totality based on a fixed and permanent distinction between thought and reality must collapse when applied to the totality.

The original form of the fixed distinction between thought and reality (i.e., non-thought) was:

T is not NT
All is either T or NT

This form is characteristic of what is called Aristotelean logic

(though of course it is probably as old as thought proper, while Aristotle was merely the earliest person known to us who enunciated it clearly and succinctly). This may be called the logic proper to things. Any particular thought form that fits this logic can, of course, be applicable to a corresponding thing only under certain conditions which are required for that thing to be what it is. That is to say, a set of thought forms that follow the rules of Aristotelean logic will service as adequate guides in activities incorporating things only in some limited domain beyond which these things must change or behave in new ways, so that other thought forms will then be needed.

When we come to consider the 'totality of all that is', however, our primary concern is, as we have seen, not with conditioned things but with the unconditioned totality that is the ultimate ground of all. Here, the rules enunciated by Aristotle break down, in the sense that there is not even a limited domain or set of conditions under which they could apply: for, in addition to the Aristotelean rules, we have to assert the following:

T *is* NT
NT *is* T

All is *both* T and NT (i.e., the two merge and flow into each other, in a single unbroken process, in which they are ultimately one).

All is *neither* T *nor* NT (i.e., the ultimate ground is unknown, and therefore not specifiable, neither as T nor NT, nor in any other way).

If the above is combined with the original 'T is not NT' and 'All is either T or NT', and if we further suppose that 'T' and 'NT' are names of *things*, we will imply absolute self-contradiction. What we are doing here is to regard this whole combination as an indication that 'T' and 'NT' are not names of things. Rather, as

indicated earlier, they are to be considered as terms in our discourse whose function is to dispose the mind to an act of intelligent perception, in which what is called for is to discern, in each case, what content originates in thought (i.e., the response of memory) and what content originates in some 'reality' that is independent of thought. Since the reality that is independent of thought is ultimately unknown and unknowable, such a discernment evidently cannot take the form of assigning a particular feature of the content to a particular fixed category, T or NT. Rather, if there is an awareness of the ever-changing *totality*, of what originates in thought (i.e., in the response of memory, which is the field of the known), then, by implication, whatever is *not* in this totality has to be treated as originating independent of thought.

It is clearly extremely important that no part of what originates in the response of memory be missed or left out of awareness. That is to say, the primary 'mistake' that can be made in this field is not the *positive* one of wrongly assigning what originates in thought to a reality independent of thought. Rather, it is the *negative* one of overlooking or failing to be aware that a certain movement originates in thought, and thus implicitly treating that movement as originating in non-thought. In this way, what is actually the one single process of thought is tacitly treated as if it were split in two parts (but of course without one being aware that this is happening). Such unconscious fragmentation of the process of thought must lead to distortion in all of perception.

For if one is thus led to attribute one's own responses of memory to a reality that would be independent of these responses, there will be a further 'feedback' leading to more irrelevant thoughts about this 'independent reality'. These thoughts will constitute yet further inappropriate responses of memory which add to this 'independent reality' in a self-maintaining process that is generally very hard to break out of.

This kind of feedback (which we have indicated earlier in connection with the analogy in which thought is regarded as similar to a radio receiver) will eventually tend to confuse the entire operation of the mind.

5 THE FIELD OF KNOWLEDGE, CONSIDERED AS PROCESS

In ordinary experience, in which we deal with sensuously perceivable things, it is usually possible sooner or later for intelligent perception to discern clearly the totality of those aspects of experience originating in thought (and by implication the totality of those originating independently of thought). However, as we have seen, in thought that aims to have totality as its content it is much harder to have such clarity, on the one hand because this thought is so intense, continuous and total that it gives a strong impression of reality, and on the other hand because there are no sensuously perceivable 'things' against which it could be tested. It is thus quite easy, through inadequate attention to the actual process of one's thought, to 'slip into' a form of conditioned response of memory, in which one is not alert to the fact that is still only a form of thought, a form that aims to give a view of 'the whole of reality'. So, 'by default' one falls into the trap of tacitly treating such a view as originating independently of thought, thus implying that its content *actually* is the whole of reality.

From this point on, one will see, in the whole field accessible to one, no room for change in the overall order, as given by one's notions of totality, which indeed must now seem to encompass all that is possible or even thinkable. This means, however, that our knowledge about 'the whole of reality' will then have to be regarded as having a fixed and final form, which reflects or reveals a correspondingly fixed and final form of what this total reality actually is. To adopt such an attitude will

evidently tend to prevent that free movement of the mind needed for clarity of perception, and so will contribute to a pervasive distortion and confusion, extending into every aspect of experience.

As indicated earlier, thought with totality as its content has to be considered as an art form, like poetry, whose function is primarily to give rise to a new perception, and to action that is implicit in this perception, rather than to communicate reflective knowledge of 'how everything is'. This implies that there can no more be an ultimate form of such thought than there could be an ultimate poem (that would make all further poems unnecessary).

Any particular form of thinking about the totality does indeed indicate a way of looking at our whole contact with reality, and thus it has implications for how we may act in this contact. However, each such way of looking is limited, in the sense that it can lead to overall order and harmony only up to some point, beyond which it must cease to be relevant and fitting. (Compare with the notion of truth in function in chapter 2.) Ultimately, the actual movement of thought embodying any particular notion of totality has to be seen as a process, with ever-changing form and content. If this process is carried out properly, with attention to and awareness of thought in its actual flux of becoming, then one will not fall into the habit of treating the content tacitly as a final and essentially static reality that would be independent of thought.

Even this statement about the nature of our thinking is, however, itself only a form in the total process of becoming, a form which indicates a certain order of movement of the mind, and a certain disposition needed for the mind to engage harmoniously in such movement. So there is nothing final about it. Nor can we tell where it will lead. Evidently, we have to be open to further fundamental changes of order in our thought as we go on with the process. Such changes have to come about in fresh and

creative acts of insight, which are necessary for the orderly movement of such thought. What we are suggesting in this chapter is, then, that only a view of knowledge as an integral part of the total flux of process may lead generally to a more harmonious and orderly approach to life as a whole, rather than to a static and fragmentary view which does not treat knowledge as process, and which splits knowledge off from the rest of reality.

It is important in this context to emphasize that permanently to identify certain views concerning the totality as belonging to Whitehead, or to someone else, is to interfere with treating knowledge *consistently* as an integral part of an overall process. Indeed, whoever takes up Whitehead's views is actually taking these as a point of departure, in a further process of the *becoming of knowledge*. (Perhaps we could say that he is working further down the 'stream of knowledge'.) In this process, some aspects may change fairly slowly, while others change more rapidly, but the key point to keep in mind is that the process has no definable aspect that is *absolutely* fixed. Intelligent perception is of course needed, for moment to moment, to discern those aspects that should properly change slowly and those that should properly change rapidly, as one works in the 'art form' of creation of ideas about 'the totality of all that is'.

We have to be very alert and careful here, for we tend to try to fix the essential content of our discussion in a particular concept or image, and talk about this as if it were a separate 'thing' that would be independent of our thought about it. We fail to notice that in fact this 'thing' has by now become only an image, a form in the overall process of thought, i.e., response of memory, which is a residue of past perception through the mind (either someone else's or one's own). Thus, in a very subtle way, we may once again be trapped in a movement in which we treat something originating in our own thought as if it were a reality originating independently of this thought.

We can keep out of this trap by being aware that the actuality

of knowledge is a living process that is taking place *right now* (e.g. in this room). In such an actual process, we are not just talking about the movement of knowledge, as if looking at it from the outside. We are actually taking part in this movement, and are aware that this is indeed what it is happening. That is to say, it is a genuine reality for all of us, a reality which we can observe and to which we can give our attention.

The key question is, then: 'Can we be aware of the ever-changing and flowing reality of this actual process of knowledge?' If we can think from such awareness, we will not be led to mistake what originates in thought with what originates in reality that is independent of thought. And thus, the art of thinking with totality as its content may develop in a way that is free of the confusion inherent in those forms of thought which try to define, once and for all, what 'the whole of reality is', and which therefore lead us to mistake the content of such thought for the overall order of a total reality that would be independent of thought.

4

HIDDEN VARIABLES IN THE QUANTUM THEORY

The question of whether there are hidden variables underlying the quantum theory was thought to have been settled definitely in the negative long ago. As a result, the majority of modern physicists no longer regard this question as relevant for physical theory. In the past few years, however, a number of physicists, including the author, have developed a new approach to this problem, which raises the question of hidden variables again.[1] It is my purpose here to review briefly the main features of what has been accomplished thus far in this new approach, and therefore to indicate some general lines on which theories involving hidden variables are currently developing.

In the course of this chapter, we shall show a number of reasons why theories involving hidden variables promise to be significant for the treatment of new physical problems, especially those arising in the domain of very short distances (of the order of 10^{-13}cm or less) and of very high energies (of the order

of 10^9 ev or more). Finally, we shall answer the main objections that have been raised against the notion of hidden variables; i.e. the difficulties of dealing with the Heisenberg indeterminacy relations, the quantization of action, the paradox of Einstein, Rosen and Podolsky, and von Neumann's arguments against the possibility of such variables.

1 MAIN FEATURES OF THE QUANTUM THEORY

In order to understand the way the theory of hidden variables has developed, it is first of all necessary to keep clearly in mind the main features of the quantum theory. Although there are several alternative formulations of this theory (due to Heisenberg, Schrödinger, Dirac, von Neumann, and Bohr), which differ somewhat in interpretation,[2] they all have the following basic assumptions in common:

1 The fundamental laws of the quantum theory are to be expressed with the aid of a *wave function* (in general, many dimensional), which satisfies a linear equation (so that solutions can be superposed linearly).

2 All physical results are to be calculated with the aid of certain 'observables', represented by Hermitian operators, which operate linearly on the wave function.

3 Any particular observable is definite (sharply defined) only when the wave function is an eigenfunction of the corresponding operator.

4 When the wave function is not an eigenfunction of this operator, then the result of a measurement of the corresponding observable cannot be determined beforehand. The results of a series of measurements on an ensemble of systems represented by the same wave function will fluctuate at random (lawlessly) from one case to the next, over the various possibilities.

5 If the wave function is given by

$$\psi = \sum_n C_n \psi_n$$

where ψ_n is the eigenfunction of the operator in question corresponding to the *n*th eigenvalue, the probability of obtaining the *n*th eigenvalue in a large ensemble of measurements will be given by $P_n = | C_n |^2$.

6 Because of the non-commutation of many operators (such as *p* and *x*) which correspond to variables that must be defined together in classical mechanics, it follows that no wave functions can exist which are simultaneous eigenfunctions of all the operators that are significant for a given physical problem. This means that not all physically significant observables can be determined together, and even more important, that those which are not determined will fluctuate lawlessly (at random) in a series of measurements on an ensemble represented by the same wave function.

2 LIMITATIONS ON DETERMINISM IMPLIED BY THE QUANTUM THEORY

From the features described in the previous section, one sees immediately that there exists a certain limitation on the degree to which the results of *individual* measurements are determined according to the quantum theory. This limitation applies to any measurement that depends appreciably on the quantum properties of matter. Thus, in an ensemble of radioactive nuclei, the decay of each nucleus can be detected *individually* by the click of a Geiger counter. A more detailed study of the quantum mechanics of the problem shows that the operator corresponding to the measurement of a decay product does not commute with the operator whose eigenfunctions represent the undisintegrated. Thus it follows that if we begin with an ensemble of undisintegrated nuclei, represented by the same wave function, each

individual nucleus will decay at an unpredictable time. This time will vary from one nucleus to another in a lawless way, while only the mean fraction that decays in a given interval of time can be predicted approximately from the wave function. When such predictions are compared with experiment, it is indeed discovered that there is a random distribution of clicks of the Geiger counter, together with a regular mean distribution that obeys the probability laws implied by the quantum theory.

3 ON THE INTERPRETATION OF INDETERMINISM IN THE QUANTUM THEORY

From the fact that quantum theory agrees with experiment in so wide a domain (including the problem treated in the previous section as a special but typical case), it is evident that the indeterministic features of quantum mechanics are in some way a reflection of the real behaviour of matter in the atomic and nuclear domains, but here the question arises as to just how to interpret this indeterminism.

To clarify the meaning of this question, we shall consider some analogous problems. Thus, it is well known that insurance companies operate on the basis of certain statistical laws, which predict to a high degree of approximation the mean number of people in a given class of age, height, weight, etc., that will die of a certain disease in a specified period of time. They can do this even though they cannot predict the precise time of death of an individual policy-holder, and even though such individual deaths are distributed at random in a way having no lawful relationship to the kind of data that the insurance company is able to collect. Nevertheless, the fact that statistical laws of this kind are operating does not prevent the simultaneous operation of individual laws which determine in more detail the precise conditions of death of each policy-holder (e.g., a man may cross a road at a particular time and be struck by a car, he may be

exposed to disease germs while he is in a weak state, etc.), for when the same result (death) can be produced by a large number of essentially independent causes, there is no reason why these causes should not be distributed in just such a way as to lead to statistical laws in a large aggregate.

The importance of such considerations is quite evident. Thus, in the field of medical research, the operation of statistical laws is never regarded as a reason against the search for more detailed individual laws (e.g., as to what makes a given individual die at a given time, etc.).

Similarly, in the field of physics, when it was discovered that spores and smoke particles suffer a random movement obeying certain statistical laws (the Brownian motion) it was supposed that this was due to impacts from myriads of molecules, obeying deeper individual laws. The statistical laws were then seen to be consistent with the possibility of deeper individual laws, for, as in the case of insurance statistics, the overall behaviour of an individual Brownian particle would be determined by a very large number of essentially independent factors. Or, to put the case more generally: *lawlessness of individual behaviour in the context of a given statistical law is, in general, consistent with the notion of more detailed individual laws applying in a broader context*.

In view of the above discussion, it seems evident that, at least on the face of the question, we ought to be free to consider the hypothesis that results of individual quantum-mechanical measurements are determined by a multitude of new kinds of factors, outside the context of what can enter into the quantum theory. These factors would be represented mathematically by a further set of variables, describing the states of new kinds of entities existing in a deeper, sub-quantum-mechanical level and obeying qualitatively new types of individual laws. Such entities and their laws would then constitute a new side of nature, a side that is, for the present 'hidden'. But then the atoms, first postulated to explain Brownian motion and large-scale regularities, were also

originally 'hidden' in a similar way, and were revealed in detail only later by new kinds of experiments (e.g., Geiger counters, cloud chambers, etc.) that were sensitive to the properties of individual atoms. Similarly, one may suppose that the variables describing the sub-quantum-mechanical entities will be revealed in detail when we have discovered still other kinds of experiments, which may be as different from those of the current type as the latter are from experiments that are able to reveal the laws of the large-scale level (e.g., measurements of temperature, pressure, etc.).

At this point it must be stated that as is well known – the majority of modern theoretical physicists[3] have come to reject any suggestion of the type described above. They do this mainly on the basis of the conclusion that the statistical laws of the quantum theory are incompatible with the possibility of deeper individual laws. In other words, while they would in general admit that some kinds of statistical laws are consistent with the assumption of further individual laws operating in a broader context, they believe that quantum mechanics could never satisfactorily be regarded as a law of this kind. The statistical features of the quantum theory are thus regarded as representing a kind of irreducible lawlessness of *individual* phenomena in the quantum domain. All individual laws (e.g. classical mechanics) are then regarded as limiting cases of the probability laws of the quantum theory, approximately valid for systems involving large numbers of molecules.

4 ARGUMENTS IN FAVOUR OF THE INTERPRETATION OF QUANTUM-MECHANICAL INDETERMINISM AS IRREDUCIBLE LAWLESSNESS

We shall now consider the main arguments on which is based the conclusion that quantum-mechanical indeterminism represents a kind of irreducible lawlessness.

4.1 Heisenberg's indeterminacy principle

We begin with a discussion of Heisenberg's indeterminacy principle. He showed that even if one supposes that the physically significant variables actually existed with sharply defined values (as is demanded by classical mechanics) then we could never measure all of them simultaneously, for the interaction between the observing apparatus and what is observed always involves an exchange of one or more indivisible and uncontrollably fluctuating quanta. For example, if one tries to measure the coordinate, x, and the associated momentum, p, of a particle, then the particle is disturbed in such a way that the maximum accuracy for the simultaneous determination of both is given by the well-known relation $\Delta p \Delta x \geqslant h$. As a result, even if there were deeper sub-quantum laws determining the precise behaviour of an individual electron, there would be no way for us to verify by any conceivable kind of measurement that these laws were really operating. It is therefore concluded that the notion of a sub-quantum level would be 'metaphysical', or empty of real experimental content. Heisenberg argued that it is desirable to formulate physical laws in terms of the minimum possible number of such notions, for they add nothing to the physical predictions of the theory, while they complicate the expression in an irrelevant way.

4.2 Von Neumann's arguments against hidden variables

The next of the main arguments against hidden variables, i.e., that of von Neumann, will now be presented in a simplified form.

From postulates (4), (5) and (6) of section 1, it follows that no wave function can describe a state in which *all* physically significant quantities are 'dispersionless' (i.e., sharply defined and free from statistical fluctuation). Thus, if a given variable

(say p) is fairly well defined, the conjugate variable (x) must fluctuate over a broad range. Let us suppose that, when the system is in such a state, there are hidden variables on a deeper level which determine just how x is going to fluctuate in each instance. Of course, we would have no need to determine the values of these hidden variables, and in a statistical ensemble of measurements of x, we would still obtain the same fluctuations as are predicted by the quantum theory. Nevertheless, each case that was going to give a certain value of x would belong to a certain set of values of the hidden variables, and as a result the ensemble could be regarded as made up of a corresponding set of distinct and clearly defined sub-ensembles.

Von Neumann argued, however, that such a set of distinct and clearly defined sub-ensembles is not consistent with certain other essential characteristics of the quantum theory, i.e., those associated with the *interference* between parts of the wave function corresponding to different values of x. To demonstrate this interference, we could refrain from measuring x but instead we do a third kind of measurement, which determines an observable that is sensitive to the form of the wave function over a wide region of space. For example, we could pass the particles through a grating and measure the diffraction pattern. (Von Neumann[4] actually discussed the case of an observable that corresponds to a sum of two or more non-commuting operators; but it is evident that in an interference experiment we realize physically an example of just such an observable, since the final result determines some complex combinations of position and momentum operators for the observed system.)

It is well known that in such an experiment a statistical interference pattern is still obtained, even if we pass the particles through the apparatus at intervals so far apart that each particle essentially enters separately and independently of all the others. But, if the whole ensemble of such particles were to split into

sub-ensembles, each corresponding to the electron striking the grating at a definite value of x, then the statistical behaviour of every sub-ensemble would be represented by a state corresponding to a delta function of the point in question. As a result, a single sub-ensemble could have no interference that would represent the contributions from different parts of the grating. Because the electrons enter separately and independently no interference between sub-ensembles corresponding to different positions will be possible either. In this way we show that the notion of hidden variables is not compatible with the interference properties of matter, which are both experimentally observed and necessary consequences of the quantum theory.

Von Neumann generalized the above argument and made it more precise; but he came to essentially the same result. In other words, he concluded that nothing (not even hypothetical hidden variables) can be consistently supposed to determine beforehand the results of an individual measurement in more detail than is possible according to the quantum theory.

4.3 The paradox of Einstein, Rosen and Podolsky

The third important argument against hidden variables is closely connected with the analysis of the paradox of Einstein *et al.*[5] This paradox arose out of the point of view, originally rather widespread, of regarding the indeterminacy principle as *nothing more than* an expression of the fact that there is a minimum unpredictable and uncontrollable disturbance in every measurement process. Einstein, Rosen and Podolsky then suggested a hypothetical experiment, from which one could see the untenability of the above interpretation of Heisenberg's principle.

We shall give here a simplified form of this experiment.[6] Consider a molecule of zero total spin, consisting of two atoms of spin, $\hbar/2$. Let this molecule be disintegrated by a method not influencing the spin of either atom. The total spin then remains

zero, even while the atoms are flying apart and have ceased to interact appreciably.

Now, if any component of the spin of one of the atoms (say A) is measured, then because the total spin is zero, we can immediately conclude that this component of the spin of the other atom (B) is precisely opposite. Thus, by measuring any component of the spin of the atom A, we can obtain this component of the spin of atom B, *without interacting with atom B in any way*.

If this were a classical system, no difficulties of interpretation would occur, because each component of the spin of each atom is always well defined and always remains opposite in value to the same component of the spin of the opposite atom. Thus the two spins are correlated and this permits us to know the spin of atom B when we measure that of A.

However, in the quantum theory we have the additional fact that only one component of the spin can be sharply defined at one time, while the other two are then subject to random fluctuations. If we wish to interpret the fluctuations as nothing but the result of disturbances due to the measuring apparatus, we can do this for atom A, which is directly observed, but how does atom B, which interacts in no way either with atom A or with the observing apparatus, 'know' in what direction it ought to allow its spin to fluctuate at random? The problem is made even more difficult if we consider that, while the atoms are still in flight, we are free to re-orientate the observing apparatus arbitrarily, and in this way to measure the spin of atom A in some other direction. This change is somehow transmitted *immediately* to atom B, which responds accordingly. Thus, we are led to contradict one of the basic principles of the theory of relativity, which states that no physical influences can be propagated faster than light.

The behaviour described above not only shows the untenability of the notion that the indeterminacy principle represents in essence only the effects of a disturbance due to the measuring apparatus; it also presents us with certain real difficulties if we

wish to understand the quantum-mechanical behaviour of matter in terms of the notion of a deeper level of individual law operating in the context of a set of hidden variables.

Of course, if there are such hidden variables then they might perhaps be responsible for a 'hidden' interaction between atom B and atom A, or between atom B and the apparatus that measures the spin of atom A. Such an interaction, which would be over and above those that are explicitly taken into account in the quantum theory, could then, in principle, explain how atom B 'knows' what property of atom A is being measured; but the difficulty still remains that to explain the correlation for the case in which the apparatus was re-orientated while the atoms are still in flight, we would have to assume that this interaction is carried through space at a speed greater than that of light. This aspect of the problem is evidently one that any acceptable theory of hidden variables must somehow manage to deal with in a satisfactory way.

5 BOHR'S RESOLUTION OF THE PARADOX OF EINSTEIN, ROSEN AND PODOLSKY – THE INDIVISIBILITY OF ALL MATERIAL PROCESSES

The paradox of Einstein, Rosen and Podolsky was resolved by Niels Bohr in a way that retained the notion of indeterminism in quantum theory as a kind of irreducible lawlessness in nature.[7] To do this he used the *indivisibility* of a quantum as his basis. He argued that in the quantum domain the procedure by which we analyse classical systems into interacting parts breaks down, for whenever two entities combine to form a single system (even if only for a limited period of time) the process by which they do this is not divisible. We are therefore faced with a breakdown of our customary ideas about the indefinite analysability of each process into various parts, located in definite regions of space and time. Only in the classical limit, where many quanta are

involved, can the effects of this indivisibility be neglected; and only there can we correctly apply the customary concepts of *detailed* analysability of a physical process.

To deal with this new property of matter in the quantum domain, Bohr proposed to begin with the classical level, which is immediately accessible to observation. The various events which take place in this level can be adequately described with the aid of our customary general concepts, involving indefinite analysability. It is then found that up to a certain degree of approximation these events are related by a definite set of laws, i.e., Newton's laws of motion, which would, in principle, determine the future course of these events in terms of their characteristics at a given time.

Now comes the essential point. In order to give the classical laws a real experimental content, we must be able to determine the momenta and positions of all the relevant parts of the system of interest. Such a determination requires that the system of interest be connected to an apparatus which yields some observable large-scale result that is definitely correlated to the state of the system of interest. But in order to satisfy the requirement that we must be able to know the state of the observed system by observing that of the large-scale apparatus, it must be possible, in principle at least, for us to distinguish between the two systems by means of a suitable conceptual analysis, even though they are connected and in some kind of interaction. In the quantum domain, however, such an analysis can no longer be correctly carried out. Consequently, one must regard what has previously been called the 'combined system' as a single, indivisible, overall *experimental situation*. The result of the operation of the whole experimental set-up does not tell us about the system that we wish to observe but, rather, only about itself as a whole.

The above discussion of the meaning of a measurement then leads directly to an interpretation of the indeterminacy relationships of Heisenberg. As a simple analysis shows, the impossibil-

ity of theoretically defining two non-commuting observables by a single wave function is matched exactly, and in full detail, by the impossibility of the operation together of two overall set-ups that would permit the simultaneous experimental determination of these two variables. This suggests that the non-commutativity of two operators is to be interpreted as a mathematical representation of the incompatibility of the arrangements of apparatus needed to define the corresponding quantities experimentally.

In the classical domain it is of course essential that pairs of canonically conjugate variables of the kind described above shall be defined together. Each one of such a pair describes a necessary aspect of the whole system, an aspect which must be combined with the other if the physical state of the system is to be defined uniquely and unambiguously. Nevertheless, in the quantum domain each one of such a pair, as we have seen, can be defined more precisely only in an experimental situation in which the other must become correspondingly less precisely defined. In a certain sense, each of the variables then opposes the other. Nevertheless, they still remain 'complementary' because each describes an essential aspect of the system that the other misses. Both variables must therefore still be used together but now they can be defined only within the limits set by Heisenberg's principle. As a result, such variables can no longer provide us with a definite, unique, and unambiguous concept of matter in the quantum domain. Only in the classical domain is such a concept in adequate approximation.

If there is no definite concept of matter in the quantum domain, what then is the meaning of the quantum theory? In Bohr's point of view it is just a 'generalization' of classical mechanics. Instead of relating to observable classical phenomena by Newton's equations, which are a completely deterministic and indefinitely analysable set of laws, we relate these same phenomena by the quantum theory, which provides a probabilistic set of laws that does not permit analysis of the phenomena in

indefinite detail. The same concepts (e.g., position and momentum) appear in both classical and quantum theories. In both theories, all concepts obtain their experimental content in essentially the same way, i.e., by their being related to a specific experimental set-up involving observable large-scale phenomena. The only difference between classical and quantum theories is that they involve the use of different kinds of laws to relate the concepts.

It is evident that according to Bohr's interpretation nothing is measured in the quantum domain. Indeed, in his point of view, there can be nothing to measure there, because all 'unambiguous' concepts that could be used to describe, define, and think about the meaning of the results of such a measurement belong to the classical domain only. Hence, there can be no talk about the 'disturbance' due to a measurement, since there is no meaning to the supposition that there was something there to be disturbed in the first place.

It is now clear that the paradox of Einstein, Rosen and Podolsky will not arise, because the notion of some kind of actually existing molecule, which was originally combined, and which later 'disintegrated', and which was 'disturbed' by the 'spin-measuring' device, has no meaning either. Such ideas should be regarded as nothing more than picturesque terms that it is convenient to use in describing the whole experimental set-up by which we observe certain correlated pairs of classical events (e.g., two parallel 'spin-measuring' devices that are on opposite sides of the 'molecule' will always register opposite results).

As long as we restrict ourselves to computing the probabilities of pairs of events in this way, we will not obtain any paradoxes similar to that described above. In such a computation the wave function should be regarded as just a mathematical symbol, which will help us to calculate the right relationships between classical events, provided that it is manipulated in accordance

with a certain technique, but which has no other significance whatsoever.

It is now clear that Bohr's point of view necessarily leads us to interpret the indeterministic features of the quantum theory as representing irreducible lawlessness; for, because of the indivisibility of the experimental arrangement as a whole, there is no room in the conceptual scheme for an ascription of causal factors which is more precise and detailed than that permitted by the Heisenberg relations. This characteristic then reveals itself as an irreducible random fluctuation in the detailed properties of the individual large-scale phenomena, a fluctuation, however, that still satisfies the statistical laws of the quantum theory. Bohr's rejection of hidden variables is therefore based on a very radical revision of the notion of what a physical theory is supposed to mean, a revision that in turn follows from the fundamental role which he assigns to the indivisibility of the quantum.

6 PRELIMINARY INTERPRETATION OF QUANTUM THEORY IN TERMS OF HIDDEN VARIABLES

In this section, we shall sketch the general outlines of certain proposals toward a specific new interpretation of the quantum theory, involving hidden variables. It must be emphasized at the outset that these proposals are only preliminary in form. Their main purpose is twofold: first, to point out in relatively concrete terms the meaning of some of our answers to the arguments against hidden variables that were summed up in the previous sections, and second, to serve as a definite starting point for the further and more detailed development of the theory, which will be discussed in later sections of this chapter.

The first systematic suggestions for an interpretation of the quantum theory in terms of hidden variables were made by the author.[8] Based at first on an extension and completion of certain

ideas originally proposed by de Broglie,[9] this new interpretation was then carried further in a later work jointly by the author and Vigier.[10] After some additional development, it finally took a form the main points of which will be summarized as follows:[11]

1 The wave function, ψ, is assumed to represent an objectively real field and not just a mathematical symbol.

2 We suppose that there is, beside the field, a particle represented mathematically by a set of coordinates, which are always well defined and which vary in a definite way.

3 We assume that the velocity of this particle is given by

$$\vec{v} = \frac{\nabla S}{m} \tag{1}$$

where m is the mass of the particle, and S is a phase function, obtained by writing the wave function as $\psi = Re^{iS/\hbar}$, with R and S real.

4 We suppose that the particle is acted on not only by the classical potential V ($\mathbf{x}$) but also by an additional 'quantum potential',

$$U = -\frac{\hbar^2}{2m}\frac{\nabla^2 R}{R}. \tag{2}$$

5 Finally, we assume that the field ψ is actually in a state of very rapid random and chaotic fluctuation, such that the values of ψ used in the quantum theory are a kind of average over a characteristic interval of time, τ. (This time interval must be long compared with the mean periods of the fluctuations described above but short compared with those of quantum-mechanical processes.) The fluctuations of the ψ-field can be regarded as coming from a deeper sub-quantum-mechanical level, in much the same way that the fluctuations in the

Brownian motion of a microscopic liquid droplet come from a deeper atomic level. Then, just as Newton's laws determine the mean behaviour of such a droplet, so Schrödinger's equation will determine the mean behaviour of the ψ-field.

On the basis of the above postulates, it is now possible to prove an important theorem, for, if the ψ-field fluctuates, then Eq. (1) implies that corresponding fluctuations will be communicated to the particle motion by the fluctuating quantum potential (2). Thus, the particle will not follow a completely regular trajectory but will have a track resembling that displayed in the usual kind of Brownian-motion particle. In this track there will be a certain *average* velocity given by an average of Eq. (1) over the field fluctuations occurring during the characteristic interval, τ. Then, on the basis of certain very general and reasonable assumptions concerning the fluctuations, which are described in detail elsewhere,[12] one can show that in its random motions the particle will spend the mean fraction of its time in the volume element, dV, of

$$P = |\psi|^2 \, dV. \tag{3}$$

Thus, the field ψ is interpreted mainly as determining the motion through (1) and the 'quantum potential' through (2). The fact that it also determines the usual expression for the probability density then follows as a consequence of certain stochastic assumptions on the fluctuations of ψ.

It has been demonstrated[13] that the above theory predicts physical results that are identical with those predicted by the usual interpretation of the quantum theory, but it does so with the aid of very different assumptions concerning the existence of a deeper level of individual law.

To illustrate the essential differences between the two points of view, consider an interference experiment in which electrons of definite momentum are incident on a grating. The associated

wave function ψ is then diffracted by the grating in relatively definite directions, and one obtains a corresponding 'interference pattern' from a statistical ensemble of electrons which have passed through the system.

As we saw in previous sections, the usual point of view does not permit us to analyse this process in detail, even conceptually; nor does it permit us to regard the places at which individual electrons will arrive as determined beforehand by the hidden variables. It is our belief, however, that this process can be analysed with the aid of a new conceptual model. This model is based, as we have seen, on the supposition that there is a particle following a definite but randomly fluctuating track, the behaviour of which is strongly dependent on an objectively real and randomly fluctuating ψ-field, satisfying Schrödinger's equation in the mean. When the ψ-field passes through the grating, it diffracts in much the same way as other fields would (e.g., the electromagnetic). As a result, there will be an interference pattern in the later intensity of the ψ-field, an interference pattern that reflects the structure of the grating. But the behaviour of the ψ-field also reflects the hidden variables in the sub-quantum level, which determine the details of its fluctuations around the mean value, obtained by solving Schrödinger's equation. Thus, the place where each particle will arrive is finally determined in principle by a combination of factors including the initial position of the particle, the initial form of its ψ-field, the systematic changes of the ψ-field due to the grating, and the random changes of this field originating in the sub-quantum level. In a statistical ensemble of cases having the same mean initial wave function, the fluctuations of the ψ-field will, as has been shown,[14] produce just the same interference pattern that is predicted in the usual interpretation of the quantum theory.

At this point, we must ask how we have been able to come to a result opposite to that deduced by von Neumann (section 4.2). The answer is to be found in a certain unnecessarily restrictive

assumption behind von Neumann's arguments. This assumption is that the particles arriving at the grating in a given position, x (determined beforehand by the hidden variable), must belong to a sub-ensemble having the same statistical properties as those of an ensemble of particles whose position, x, has actually been measured (and whose functions are therefore all a corresponding delta function of position). Now it is well known that if the position of each electron as it passes through the grating were to be measured, no interference would be obtained (because of the disturbance due to the measurement that causes the system to divide into the non-interfering ensembles represented by delta functions as discussed in section 4.2). Hence, von Neumann's procedure is equivalent to an implicit assumption, that *any* factors (such as hidden variables) which determine x beforehand must destroy interference in the same way as it is destroyed in a measurement of the coordinate x.

In our model, we go beyond the above implicit assumption by admitting at the outset that the electron has more properties than can be described in terms of the so-called 'observables' of the quantum theory. Thus, as we have seen, it has a position, a momentum, a wave field, ψ, and sub-quantum fluctuations, all of which combine to determine the detailed behaviour of each individual system with the passage of time. As a result, the theory has room to describe within it the difference between an experiment in which the electrons pass through the grating undisturbed by anything else, and one in which they are disturbed by a position-measuring apparatus. These two sets of experimental conditions would lead to very different ψ-fields, even if in both cases the particles were to strike the grating at the same position. The differences in the subsequent behaviour of the electron (i.e., interference in one case and not in the other) will therefore follow from the different ψ-fields which exist in the two cases.

To summarize, we need not restrict ourselves to von

Neumann's assumptions that sub-ensembles are to be classified only in terms of the values of quantum-mechanical 'observables'. Rather, such a classification must also involve further inner properties, at present 'hidden', which can later influence the directly observable behaviour of the system (as in the example we have discussed).

Finally, it is possible to study in a similar way how other characteristic problems are treated in terms of our new interpretation of the quantum theory (e.g., the Heisenberg indeterminacy relation, and the paradox of Einstein, Rosen and Podolsky). This has in fact been done in some detail.[15] We shall, however, defer a discussion of these questions until after we have developed some additional ideas, because this will enable us to treat these problems in a simpler and clearer way than was possible previously.

7 CRITICISMS OF OUR PRELIMINARY INTERPRETATION OF QUANTUM THEORY IN TERMS OF HIDDEN VARIABLES

The interpretation of the quantum theory discussed in the previous section is subject to a number of serious criticisms.

First of all, it must be admitted that the notion of the 'quantum potential' is not entirely a satisfactory one, for not only is the proposed form, $U = -(\hbar^2/2m)(\nabla^2 R/R)$, rather strange and arbitrary but also (unlike other fields such as the electromagnetic) it has no visible source. This criticism by no means invalidates the theory as a logical self-consistent structure but only attacks its plausibility. Nevertheless, we evidently cannot be satisfied with accepting such a potential in a definitive theory. Rather, we should regard it as at best a schematic representation of some more plausible physical idea to which we hope to advance later, as we develop the theory further.

Second, in the many-body problem, we are led to introduce a

many-dimensional ψ-field $[\psi(x_1, x_2, \ldots, x_n, \ldots, xN)]$ and a corresponding many-dimensional quantum potential

$$U = -\frac{\hbar^2}{2m}\sum_{i=1}^{N}\frac{\nabla_i^2 R}{R},$$

with $\psi = Re^{is/\hbar}$ as in the one-body case. The momentum of each particle is then given by

$$P_i = \frac{\partial S(x_1 \ldots x_n \ldots x_N)}{\partial x_i}. \tag{4}$$

All of these notions are quite consistent logically. Yet it must be admitted that they are difficult to understand from a physical point of view. As best, they should be regarded, like the quantum potential itself, as schematic or preliminary representations of certain features of some more plausible physical ideas to be obtained later.

Third, the criticism has been levelled against this interpretation that the precise values of the fluctuating ψ-field and of the particle coordinates are empty of real physical content. The theory has been constructed in just such a way that the observable large-scale results of any possible kind of measurements are identical with those predicted by current quantum theory. In other words, from the experimental results, one can find no evidence for the existence of the hidden variables, nor does the theory permit their definition to be ever good enough to predict any result more accurately than the current quantum theory does.

The answer to this criticism must be considered in two contexts. First of all, it should be kept in mind that before this proposal was made there had existed a widespread impression that no conceptions of hidden variables at all, not even if they

were abstract, and hypothetical, could possibly be consistent with the quantum theory. Indeed, to prove the impossibility of such a conception was the basic aim of von Neumann's theorem. Thus, to a considerable extent, the question had already been raised in an abstract way in certain aspects of commonly held formulations of the usual interpretation of the quantum theory. To show that it was wrong to throw out hidden variables because they could not be imagined, it was therefore sufficient to propose any logically consistent theory that explained the quantum mechanics, through hidden variables, no matter how abstract and hypothetical it might be. Thus, the existence of even a single consistent theory of this kind showed that whatever arguments one might continue to use against hidden variables, one could no longer use the argument that they are inconceivable. Of course, the specific theory that was proposed was not satisfactory for general physical reasons, but if one such theory is possible, then other and better theories may also be possible, and the natural implication of this argument is 'Why not try to find them?'

Secondly, to answer in full the criticism that these ideas are purely hypothetical we note that the logical structure of the theory makes room for the possibility of its being changed in such a way that it ceases to be completely identical with the current quantum mechanics in its experimental content. As a result, the details of the hidden variables (e.g. the fluctuations of the ψ-field and of the particle positions) will be able to reveal themselves in new experimental results not predicted by the quantum theory as it is now formulated.

At this point, one might perhaps raise the question as to whether such new results are even possible. After all, does not the general framework of the quantum theory already fit in with all known experimental results, and if so, how could there be any others?

To answer this question, we first point out that even if there

existed no known experiments that the current quantum-theoretical framework failed to treat satisfactorily, the possibility would always still be open for new experimental results, not fitting into this framework. All experiments are necessarily done only in some limited domain, and even in this domain, only to a limited degree of approximation. Room is therefore always left open, logically speaking, for the possibility that when experiments are done in new domains and to new degrees of approximation, results will be obtained that do not fit completely into the framework of the current theories.

Physics has quite frequently developed in the way described above. Thus, Newtonian mechanics, thought originally to be of completely universal validity, was eventually found to be valid in a limited domain (velocity small compared with that of light) and only to a limited degree of approximation. Newtonian mechanics had to give way to the theory of relativity which utilized basic conceptions concerning space and time which were in many ways not consistent with those of Newtonian mechanics. The new theory was, therefore, in certain essential features qualitatively and fundamentally different from the old one. Nevertheless, within the domain of low velocities, the new theory approached the old one as a limiting case. In a similar way, classical mechanics eventually gave way to the quantum theory, which is very different in its basic structure, but which still contains classical theory as a limiting case, valid approximately in the domain of large quantum numbers. Agreement with experiments in a limited domain and to a limited degree of approximation is evidently no proof, therefore, that the basic concepts of a given theory have a completely universal validity.

From the above discussion we see that the experimental evidence taken by itself will always leave open the possibility of a theory of hidden variables that yields results differing from those of the quantum theory in new domains (and even in the old domains when carried to a sufficiently high degree of

approximation). Now, however, we must have some more definite ideas as to which are the domains in which we expect the results to be new, and as to just what are the ways in which they ought to be new.

Here, we may hope to get some clues by considering problems in a domain where current theories do not yield generally satisfactory results, i.e. one connected with very high energies and very short distances. With regard to such problems, we first note that the present relativistic quantum field theory meets severe difficulties which raise serious doubts as to its internal self-consistency. There are the difficulties arising in connection with the divergences (infinite results) obtained in calculations of the effects of interactions of various kinds of particles and fields. It is true that for the special case of electromagnetic interactions such divergences can be avoided to a certain extent by means of the so-called 'renormalization' techniques. It is by no means clear, however, that these techniques can be placed on a secure logical mathematical basis.[16] Moreover, for the problem of mesonic and other interactions, the renormalization method does not work well even when considered as a purely technical manipulation of mathematical symbols, apart from the question of its logical justification. While it has not been proved conclusively, as yet, that the infinities described above are essential characteristics of the theory, there is already a considerable amount of evidence in favour of such a conclusion.[17]

It is generally agreed that, if as seems rather likely, the theory does not converge, then some fundamental change must be made in its treatment of interactions involving very short distances, from which domain all the difficulties arise (as one sees in a detailed mathematical analysis).

Most of the proponents of the usual interpretation of the quantum theory would not deny that such a fundamental change seems to be needed in the present theory. Indeed, some of them, including Heisenberg, are even ready to go so far as to

give up completely our notions of a definable space and time, in connection with such very short distances, while comparably fundamental changes in other principles, such as those of relativity, have also been considered by a number of physicists (in connection with the theory of non-local fields). But there seems to exist a widespread impression that the principles of quantum mechanics almost certainly will not have to be changed in essence. In other words, it is felt that however radical the changes in physical theories may be they will only build upon the principles of the present quantum theory as a foundation, and perhaps enrich and generalize these principles by supplying them with a newer and broader scope of application.

I have never been able to discover any well-founded reasons as to why there exists so high a degree of confidence in the general principles of the current form of the quantum theory. Several physicists[18] have suggested that the trend of the century is away from determinism, and that a step backwards is not very likely. This, however, is a speculation of a kind that could easily be made in any period concerning theories that have hitherto been successful. (For example, classical physicists of the nineteenth century could have argued with equal justification that the trend of the times was toward *more* determinism, whereas future events would have proved this speculation wrong. Still others have adduced a psychological preference for indeterministic theories, but this may well be just a result of their having become accustomed to such theories. Classical physicists of the nineteenth century would surely have expressed an equally powerful psychological bias toward determinism.)

Finally, there is a widespread belief that it will not really be possible to carry out our suggested programme of developing a theory of hidden variables which will be genuinely different in experimental content from the quantum theory, and which will still agree with the latter theory in the domain where this theory is already known to be essentially correct. This view is held in

particular by Niels Bohr, who expressed especially strong doubts[19] that such a theory could treat all significant aspects of the problem of the *indivisibility* of the quantum of action – but then this argument stands or falls on the question of whether an alternative theory of the kind described above can really be produced, and in the next sections, we shall see that such a position is not a very secure one.

8 STEPS TOWARD A MORE DETAILED THEORY OF HIDDEN VARIABLES

From the discussion given in the previous section, it is clear that our central task is to develop a new theory of hidden variables. This theory should be quite different from the current quantum theory both in its basic concepts and in its general experimental content, and yet be capable of yielding essentially the same results as those of the current theory in the domain in which this latter theory has thus far been verified, and to the degree of approximation of the measurements that have actually been carried out. The possibility of distinguishing between the two theories experimentally will then arise either in new domains (e.g., very short distances) or in more accurate measurements carried out in the older domains.

Our basic starting point will be to try to provide a more concrete physical theory leading to ideas resembling those discussed in connection with our preliminary interpretation (section 6). In doing this, we must first recall that we have been regarding indeterminism as a real and objective property of matter, but one associated with a given limited context (in this case that of the variables of the quantum-mechanical level). We are supposing that in a deeper sub-quantum level, there are further variables which determine in more detail the fluctuations of the results of individual quantum-mechanical measurements.

Does the existing physical theory provide us with any hints as

to the nature of these deeper sub-quantum-mechanical variables? To guide us in our search, we can begin by considering the current quantum theory in its most developed form, namely that of relativistic field theory. According to the principles of the current theory, it is essential that every field operator, ϕ_μ, be a function of a sharply defined point, $\mathbf{x}$, and that all interactions shall be between fields at the same point. This leads us to formulate our theories in terms of a non-denumerable infinity of field variables.

Of course, such a formulation must be made, even classically, but in classical physics one can assume that the fields vary *continuously*. As a result, one can effectively reduce the number of variables to a denumerable set (e.g., the average values of the fields in very small regions), essentially because the field changes over very short distances are negligibly small. As a simple calculation shows, however, this is not possible in the quantum theory, because the shorter the distances one considers, the more violent are the quantum fluctuations associated with the 'zero-point energy' of the vacuum. Indeed, these fluctuations are so large that the assumption that the field operators are continuous functions of positions (and time) is not valid in a strict sense.

Even in the usual quantum theory, the problem of a non-denumerable infinity of field variables presents several as yet unsolved basic mathematical difficulties. Thus, it is customary to deal with field theoretical calculations by starting with certain assumptions concerning the 'vacuum' state, and thereafter applying perturbation theory. Yet, in principle, it is possible to start with an infinite variety of very different assumptions for the vacuum state, involving the assignment of definite values to a set of completely discontinuous functions of the field variables, functions which 'fill' the space densely and yet leave a dense set of 'holes'. *These new states cannot be reached from the original 'vacuum' state by any canonical transformation*[20]. Hence they lead to theories that are, in general, different in physical content from those obtained

with the original starting point. It is entirely possible that because of the divergences in field theoretical results, even the current renormalization techniques imply such an 'infinitely different' vacuum state; but even more important, it is necessary to stress that a reorganization of a non-denumerable infinity of variables usually leads to a different theory, and that the principles of such a reorganization will then be equivalent to basic assumptions about the corresponding new laws of nature.

Thus far, we have restricted the above discussion to the effects of a reorganization of a non-denumerable infinity of variables within the framework of the present quantum theory, but similar conclusions will hold even for a classical theory involving a non-denumerable infinity of variables. Thus, if we once give up the assumption of the *continuity* of the classical field, we see that there is the same scope for obtaining a different classical theory in such a reorganization as there is in the quantum theory.

At this point we ask ourselves whether it would ever be possible to reorganize a classical field theory in such a way that it becomes equivalent (at least in some approximation and within some domain) to the modern quantum field theory. In order to answer this question, we must evidently reproduce from the basic 'deterministic' law of our assumed non-denumerable infinity of 'classical' field variables, the fluctuations of quantum processes, the indivisibility of the quantum, and other essential quantum-mechanical properties, such as interference and the correlations associated with the paradox of Einstein, Rosen and Podolsky. It is with these problems that we shall concern ourselves in subsequent sections.

9 TREATMENT OF QUANTUM FLUCTUATIONS

Let us begin by assuming some 'deterministic' field theory. Its precise characteristics are unimportant for our purposes here. All that is important is to suppose the following properties.

1 There is a set of field equations which completely determines the changes of the field with time.

2 These equations are sufficiently non-linear to guarantee a significant coupling between all wave components, so that (except perhaps in some approximation) solutions cannot be linearly superposed.

3 Even in the 'vacuum' the field is so highly excited that the mean field in each region, however small, fluctuates significantly, with a kind of turbulent motion that leads to a high degree of randomness in the fluctuations. *This excitation guarantees the discontinuity of the fields in the smallest regions.*

4 What we usually call 'particles' are relatively stable and conserved excitations on top of this vacuum. Such particles will be registered at the large-scale level, where all apparatus is sensitive only to those features of the field that will last a long time, but not to those features that fluctuate rapidly. Thus, the 'vacuum' will produce no visible effects at the large-scale level, since its fields will cancel themselves out on the average, and space will be effectively 'empty' for every large-scale process (e.g. as a perfect crystal lattice is effectively 'empty' for an electron in the lowest band, even though the space is full of atoms).

It is evident that there would be no way to solve such a set of field equations directly. The only possibility would be to try to deal with some kind of *average* field quantities (taken over small regions of space and time). In general, we could hope that a group of such average quantities would, at least within some approximation, *determine themselves* independently of the infinitely complex fluctuations inside the associated regions of space.[21] To the extent that this happened, we could obtain approximate field laws, associated with a certain level of size, but these laws cannot be exact because the non-linearity of the equations means fields will necessarily be coupled in some way to the inner fluctuations that have been neglected. As a result, the mean fields will also fluctuate at random about their average behaviour. There will be

a typical domain of fluctuation of the mean fields, determined by the character of the deeper field motions that have been left out. As in the case of the Brownian motion of a particle, this fluctuation will determine a probability distribution

$$dP = P(\phi_1, \phi_2, \ldots, \phi_k \ldots)\, d\phi_1\, d\phi_2 \ldots d\phi_k \ldots \tag{5}$$

which yields the mean fraction of the time in which the variables, ϕ_1, ϕ_2 . . ., ϕ_k . . ., representing the mean fields in the regions, 1, 2 . . ., k . . . respectively, will be in the range $d\phi_1$ $d\phi_2$ . . . $d\phi_k$ . . . (Note that P is in general a multidimensional function, which can describe statistical *correlations* in the field distributions.)

To sum up, we are reorganizing the non-denumerable infinity of field variables, and we are treating explicitly only some denumerable sets of these reorganized coordinates. We do this by defining a series of levels by average fields, each associated with a certain dimension, over which the averages are taken. Such a treatment can be justified only in those cases in which the denumerable sets of variables form a totality that, *within certain limits*, determines its own motions independently of the precise details of the non-denumerable infinity of coordinates that has necessarily been left out of account. Such self-determination is never complete, however, and its basic limits are defined by a certain minimum degree of fluctuation over a domain that depends on the coupling of the field coordinates in question to those that have been neglected. Thus we obtain a real and objective limitation on the degree of *self-determination* of a certain level, along with a probability function that represents the character of the statistical fluctuations which are responsible for the above described limitations on self-determination.

10 HEISENBERG'S INDETERMINACY PRINCIPLE

We are now ready to show how Heisenberg's indeterminacy principle fits into our general scheme. We shall do this by discussing the degree of determinism associated with a space-averaged field coordinate, ϕ_k, and the corresponding average of the canonically conjugate field momentum, π_k.

To simplify the discussion let us suppose that the canonical momentum is proportional to the time derivative of the field coordinate, $\partial\phi_k/\partial t$ (as is the case for many fields such as the electromagnetic, mesonic, etc.). Each such field coordinate fluctuates at random. This means that its instantaneous time derivative is infinite (as also happens in the case of the Brownian movement of a particle). As a result, there is no rigorous way to define such an instantaneous time derivative. Rather, we must discuss the average change of field, $\Delta\phi_k$, over a small region of time, Δt (just as we had to take the average also over a region of space). The average value of the field momentum over this time interval is then

$$\overline{\pi_k} = a\left(\frac{\Delta\phi_k}{\Delta t}\right) \tag{6}$$

where a is the constant of proportionality.

If the field fluctuates in a random way, then by the very definition of randomness, the region over which it fluctuates during the time, Δt is given by

$$\overline{(\delta\phi_k)^2} = b\Delta t \quad \text{or} \quad |\delta\phi_k| = b^{1/2}(\Delta t)^{1/2} \tag{7}$$

where b is another constant of proportionality, associated with the mean magnitude of the random fluctuations of the field.

Of course, the precise manner of fluctuation of the field is determined by the infinity of deeper field variables not taken

into account, but in the context of the level in question, nothing determines this precise behaviour. In other words, $|\delta\phi_k|$ represents the maximum possible degree of determination of ϕ_k within the level of field quantities averaged over similar intervals of time.

From the definition (6), we see that π_k will also fluctuate at random over the range

$$\delta\pi_k = \frac{a \mid \delta\phi_k \mid}{\Delta t} = \frac{ab^{1/2}}{(\Delta t)^{1/2}}. \tag{8}$$

Multiplying (8) and (7) together, we obtain

$$\delta\pi_k \ \delta\phi_k = ab. \tag{9}$$

Thus the product of the maximum degree of determination of π_k *and that of* ϕ_k is a constant, ab, independent of the time interval, Δt.

It is immediately clear that the above result shows a strong analogy to Heisenberg's principle,[22] $\delta p \delta q \lesssim h$. The constant, ab, appearing in Eq. (9) plays the role that Planck's constant, h, plays in Heisenberg's principle. The universality of h therefore implies the universality of ab.

Now a is just a constant relating the field momentum to its time derivative and will evidently be a universal constant. The constant, b, represents the basic intensity of the random fluctuation. To suppose that b is a universal constant is the same as to assume that the random field fluctuations are at all places, at all times, and in all levels of size, essentially the same in character.

With regard to different places and times the assumption of the universality of the constant, b, is not at all implausible. The random field fluctuations (which here play a role similar to that of the 'zero-point' vacuum fluctuations in the usual quantum theory) are infinitely large, so that any disturbances that might be

made by further localized excitations or concentrations of energy occurring naturally, or produced in a laboratory experiment, would have a negligible influence on the general magnitudes of the basic random fluctuations. (Thus, the presence of matter as we know it on a large scale would mean the concentration of a non-fluctuating part of the energy, associated with a few extra grams per cubic centimetre on top of the infinite zero-point fluctuations of the 'vacuum' field.)

With regard to the problem of different levels of space and time intervals, however, the assumption of the universality of b is not so plausible. Thus, it is quite possible that the quantity b will remain constant for fields averaged over shorter and shorter time intervals only down to some characteristic time interval Δt_0, beyond which the quantity b may change. This is equivalent to the possibility that the degree of self-determination may not be limited by Planck's constant, h, for very short times (and for correspondingly short distances).

It is easy to suggest a theory having the characteristics described above. Thus, suppose that the 'zero-point' field fluctuations were in some kind of statistical equilibrium corresponding to an extremely high temperature, T. The mean fluctuation in the energy per degree of freedom would, according to the equipartition theorem, be of the order of κT, but this mean energy is also proportional to the mean of $(\partial\phi/\partial t)^2$ (as happens for example in a collection of harmonic oscillators). Thus, we write

$$\alpha \overline{\left(\frac{\partial \phi}{\partial t}\right)^2} = \kappa T = \frac{\alpha}{b^2} \overline{(\pi)^2} \tag{10}$$

where κ is Boltzmann's constant and α is a suitable constant of proportionality.

As a result, if the time interval, Δt, appearing in Eq. (8) is made shorter and shorter, it will not be possible for $(\pi)^2$ to increase without limit as is implied by Eq. (8) and (9). Rather,

$(\pi)^2$ will stop increasing at some critical time interval defined by

$$\kappa T = \frac{\alpha}{b^2}\frac{a^2 b}{(\Delta t_0)^2}; \quad \text{or} \quad (\Delta t_0)^2 = \frac{\alpha a^2}{b\kappa T}. \tag{11}$$

For shorter time intervals (and correspondingly short distances) the degree of self-determination of the average fields would then not be limited precisely by Heisenberg's relations but instead by a weaker set of relations.

We have thus constructed a theory which contains Heisenberg's relations as a limiting case, valid approximately for fields averaged over a certain level of intervals of space and time. Nevertheless, fields averaged over smaller intervals are subject to a greater degree of self-determination than is consistent with this principle. From this, it follows that our new theory is able to reproduce, in essence at least, one of the essential features of the quantum theory, i.e. Heisenberg's principle and yet have a different content in new levels.

The question of how this new content of our theory could be revealed in experiments will be discussed in later sections. For the moment, we restrict ourselves to pointing out that the divergencies of present-day field theories are directly a result of contributions to the energy, charge, etc., coming from quantum fluctuations associated with infinitely short distance and times. Our point of view permits us to assume that while the total fluctuation is still infinite, the fluctuation per degree of freedom ceases to increase without limit as shorter and shorter times are considered. In this way, field-theoretical calculations could be made to give finite results. Thus, it is clear already that divergences of the current quantum field theory may come from the extrapolation of the basic principles of this theory to excessively short intervals of time and space.

11 THE INDIVISIBILITY OF QUANTUM PROCESSES

Our next step is to show how quantization, i.e., the indivisibility of the quantum of action, fits into our notions concerning a sub-quantum-mechanical level. To do this, we begin by considering in more detail the problem of just how to define the field averages that are needed for the treatment of a non-denumerable infinity of variables. Here, we shall guide ourselves by certain results obtained in the very analogous many-body problem (e.g., the analysis of solids, liquids, plasmas, etc., in terms of their constituent atomic particles). In this problem, we are likewise confronted with the need to treat certain kinds of averages of deeper (atomic) variables. The totality of a set of such averages then determines itself in some approximation, while its details are subject to characteristic domains of random fluctuations arising from the lower-level (atomic) motions, in much the same way that was suggested for the averages of the non-denumerable infinity of field variables discussed in the previous sections.

Now, in the many-body problem, one deals with large-scale behaviour by working with *collective coordinates*,[23] which are an approximately self-determining set of symmetrical functions of the particle variables, representing certain overall aspects of the motions (e.g., oscillations). The collective motions are determined (within their characteristic domains of random fluctuation) by approximate *constants of the motion*. For the special but very widespread case that the collective coordinates describe nearly harmonic oscillations, the constants of the motion are the amplitudes of the oscillations and their initial phases. More generally, however, they may take the form of more complex functions of the collective coordinates.

It is often very instructive to solve for the collective coordinates by means of a canonical transformation. In classical mechanics,[24] this takes the form

$$P_k = \frac{\partial S}{\partial q_k}\,(q_1 \ldots q_k \ldots; J_1 \ldots J_n)$$

$$Q_n = \frac{\partial S}{\partial J_n}\,(q_1 \ldots q_k \ldots; J_1 \ldots J_n \ldots) \qquad (12)$$

where S is the transformation function, p_k and q_k are the momenta and one coordinates of the particles, and J_n and Q_n are the momenta of the collective degrees of freedom. Here, we suppose the J_n to be constants of the motion. In other words, we assume that the transformation is such that, at least in the domain in which the approximation of collective coordinates is a good one, the Hamiltonian is only a function of the J_n, and not of the Q_n. It then follows that the Q_n increase linearly with time so that they have the properties of the so-called 'angle-variables'.[25]

It is clear that a similar attack can be made on the problem of a non-denumerable infinity of field variables subject to a non-linear coupling with each other. To do this, we now let q_k, p_k represent the original canonically conjugate set of field variables, and we assume that there will be a set of overall large-scale motions which we represent by the constants of the motion, J_n and the canonically conjugate angle-variables, Q_n. It is clear that if such overall motions exist, they will manifest themselves relatively directly in high-level interactions, for by hypothesis, they are the motions that retain their characteristic features for a long time without being lost in the infinitely rapid random fluctuations, which average out to zero on a higher level.

Our next task is to show that the constants of the motion (which are, for harmonic oscillators, proportional to the energy of a large-scale collective degree of freedom) are quantized by the rule $J = nh$, where n is an integer, and h is Planck's constant. Such a demonstration will constitute an explanation of the wave-particle duality, since the collective degrees of freedom are already known to be wavelike motions, with harmonically

oscillating amplitudes. In general, these waves will take the form of fairly localized packets, and if these packets have discrete and well-defined quantities of energy, momentum, and other properties, they will at the higher level, reproduce all the essential characteristics of particles. Yet they will have inner wavelike motions which will reveal themselves only under conditions in which there exist systems that can respond significantly to these finer details.

In order to show the quantization of the constants of the motion as described above, we first return to the preliminary interpretation of the quantum theory, given in sections 6 and 7. Here, we encountered a relation very similar to (12).

$$P_k = \frac{\partial S}{\partial q_k}(q_1 \dots q_k \dots). \tag{13}$$

The main difference between (4) and (12) is that the former does not contain any constants of the motion, whereas the latter does. But once the constants of the motion are specified, they are just numbers, which need only be given certain values which they thereafter retain. If this is done, the S of Eq. (12) will also no longer contain the J_n as explicitly represented variables. We can therefore regard the S of our preliminary interpretation, (4), as the actual S function, in which the constants of the motion have already been specified. S is then determined by the wave function, $\psi = Re^{is/\hbar}$. Thus, when we give the wave function, we define a transformation function $S = \hbar I_m\ (l_n \psi)$, which latter determines certain constants of the motion implicitly.

In order to see more clearly how the constants of the motion are determined by the S of Eq. (4) let us construct the *phase integral*

$$I_C = \sum_k \oint C p_k \delta q_k. \tag{14}$$

The integral is taken around some circuit C, representing a set of displacement, δq_k (virtual or real), in the configuration space of the system. If Eq. (13) applies, we then obtain

$$I_C = \oint \sum_k \frac{\partial S}{\partial q_k} \delta q_k = \delta S_C \tag{15}$$

where δS_C is the change of S in going around the circuit C.

It is well known that the I_C, which are the so-called 'action variables' of classical mechanics, generally represent the constants of the motion. (For example, in the case of a set of coupled oscillators, harmonic or otherwise, the basic constants of the motion can be obtained by evaluating the I_C with suitably defined circuits.)[26] The wave function, ψ, which defines a certain function, S, therefore implies a corresponding set of constants of the motion.

Now, according to the current quantum theory, the wave function, $\psi = Re^{iS/\hbar}$, is a single-valued function of all its dynamical coordinates, q_k. Thus, we must have

$$\delta S_C = 2\eta\pi\hbar = nh \tag{16}$$

where n is an integer.

The actual functions, S, obtained from the wave function, ψ, therefore imply that the basic constants of the motion for the system are discrete and quantized.

If the integer, n, is not zero, then as a simple calculation shows, there must be a discontinuity somewhere inside the circuit. But since $S = \hbar I_m (l_n \psi)$, and since ψ is a continuous function, a discontinuity of S will generally occur where ψ (and therefore R^2) has a zero. As we shall see presently, R^2 is the probability density for the system to be at a certain point in configuration space. The system will therefore have no probability of being at a

zero of ψ, with the result that the singularities of S will imply no inconsistencies in the theory.

In many ways, the quantization described above resembles the old Bohr-Sommerfeld rule; yet it is basically different in its meaning. Here, the action variable, I_C, that is quantized is not obtained by using the simple expression of classical mechanics for the p_k in Eq. (14). Rather, it is obtained by using the expression (12), which involves the transformation functions, S, a function that depends on the non-denumerable infinity of variables, q_k. In a certain sense, we can say that the old Bohr-Sommerfeld rule would be exactly correct if it were made to refer to the non-denumerable infinity of field variables, instead of just to the values of the variables that one obtains by solving the simple classical equations of motion for a small number of abstracted coordinates, Q_n.

Before going ahead to suggest an explanation of why δS_C should be restricted to the discrete values denoted by Eq. (16), we shall sum up and develop in a systematic way the main physical ideas to which we have thus far been led.

1. We abstract from the non-denumerable infinity of variables a set of 'collective' constants of the motion, J_n and their canonically conjugate quantities, Q_n.

2. The J_n can be consistently restricted to discrete integral multiples of h. Thus, action can be quantized.

3. If this set of coordinates determined itself completely, the Q_n would (as happens in typical classical theories) increase linearly with time. However, because of fluctuations due to the variables left out of the theory, the Q_n will fluctuate at random over the range accessible to them.

4. This fluctuation will imply a certain probability distribution of the Q_n having a dimensionality equal to 1 per degree of freedom (and not 2, as is the case for typical *classical* statistical distributions in phase space). When this distribution is transformed to the configuration space of the q_k there will be a

corresponding probability function, $p(q_1 \ldots q_k \ldots)$, which also has a dimensionality of 1 per degree of freedom (the momenta, p_k being always determined in terms of q_k by Eq. (12)).

5. We then interpret the wave function $\psi = Re^{is/\hbar}$, by setting $p(q_1 \ldots q_k \ldots) = R^2(q_1 \ldots q_k \ldots)$ and by letting S be the transformation function that defines the constants of the motion of the system. It is clear that we have in this way given the wave function a meaning quite different from the one that was suggested in the preliminary interpretation of section 5, even though the two interpretations stand in a fairly definite relation to each other.

6. Because of the effects of the neglected lower-level field variables, the quantities I_n will, in general, remain constant only for some limited period of time. Indeed, as the wave function changes, the integral around a given circuit, $\Sigma_k \oint_c p_k \delta q_k = \delta S_c$ will change abruptly, whenever a singularity of S (and therefore a zero of ψ) crosses the circuit, C. Hence discrete changes, by some multiple of h will occur in the action variables for non-stationary states.

12 EXPLANATION OF QUANTIZATION OF ACTION

In the previous section, we developed a theory involving a non-denumerable infinity of field variables that *has room* for the quantization of action according to the usual rules of the quantum theory. We shall now suggest a more definite theory, which will give possible physical reasons explaining why action is quantized by the rules described above, and which will show possible limitations on the domain of validity of these rules.

Our basic problem evidently is to propose some direct physical interpretation of the function, S which appears in the phase of the wave function (as $\psi = Re^{is/\hbar}$) and which is, according to our theory, also the transformation function defining the basic constants of the motion (see Eq. (15)); for if we are to explain

why the change of S around a circuit is restricted to discrete multiples of h we must evidently assume that S is somehow related to some physical system, in such a way that $e^{is/\hbar}$ cannot be other than single-valued.

To give S a physical meaning that leads to the property described above, we shall begin with certain modifications of an idea originally suggested by de Broglie.[27] Let us suppose that the infinity of non-linearly coupled field variables is in reality so organized that in each region of space and time associated with any given level of size there is taking place a periodic inner process. The precise nature of this process is not important for our discussion here, as long as it is periodic (e.g., it could be an oscillation or a rotation). This periodic process would determine a kind of inner time for each region of space, and it would therefore effectively constitute a kind of local 'clock'.

Now every localized periodic process has, by definition, some Lorentz frame in which it remains at rest, at least for some time (i.e., in which it does not significantly change its mean position during this time). We shall further assume that, in this frame, neighbouring clocks of the same level of size will tend to be nearly at rest. Such an assumption is equivalent to the requirement that, in every level of size, the division of a given region into small regions, each containing its effective clock, has a certain regularity and permanence, at least for some time. If these clocks are considered in another frame (e.g., that of the laboratory), every effective clock will then have a certain velocity, which can be represented by a continuous function $\mathbf{v}(\mathbf{x}, t)$.

It is now quite natural to suppose: (1) that in its *own rest frame* each clock oscillates with a uniform angular frequency, which is the same for all clocks, and (2), that all clocks in the same neighbourhood are, on the average, in phase with each other. In homogeneous space there can be no reason to favour one clock over another, nor can there be a favoured direction of space (as

would be implied by a non-zero average value for $\nabla\phi$ in the rest frame). We can therefore write

$$\delta\phi = \omega_0 \delta\tau \tag{17}$$

where $\delta\tau$ is the change of proper time of the clock, and where $\delta\phi$ is independent of $\delta\mathbf{x}$ in this frame.

The reason for the equality of clock phases in the rest frame for a neighbourhood can be understood more deeply as a natural consequence of the non-linearity, of the coupling of the neighbouring clocks (implied by the general non-linearity of the field equations). It is well known that two oscillators of the same natural frequency tend to come into phase with each other when there is such a coupling.[28] Of course, the relative phase will oscillate somewhat, but in the long run, and on the average, these oscillations will cancel out.

Let us now consider the problem in some fixed Lorentz frame, e.g., that of the laboratory. We then calculate the change of $\delta\phi$ $(\mathbf{x}, t)$ which would follow upon a virtual displacement $(\delta\mathbf{x}, \delta t)$. This depends only on δr. By a Lorentz transformation, we obtain

$$\delta\phi = \omega_0 \delta\tau = \frac{\omega_0[\delta t - (\mathbf{v}\cdot\delta\mathbf{x})/c^2]}{\sqrt{1 - \dfrac{v^2}{c^2}}}. \tag{18}$$

If we integrate $\delta\phi$ around a closed circuit, the change of phase, $\delta\phi_c$, should then be $2n\pi$, where n is an integer. Otherwise, the clock phases would not be single-valued functions of $\mathbf{x}$ and t. We thus obtain

$$\oint \delta\phi = \omega_0 \oint \frac{(\delta t - \mathbf{v}\cdot\delta\mathbf{x}/c^2)}{\sqrt{1 - \dfrac{v^2}{c^2}}} = 2n\pi. \tag{19}$$

If we now suppose that each effective clock has some rest mass, m_0, and if we write for the total energy of translation of the clock, $E = m_0c^2/\sqrt{1 - (v^2/c^2)}$, and for the corresponding momentum, $\mathbf{p} = m_0\mathbf{v}/\sqrt{1 - (v^2/c^2)}$ we get

$$\oint (E\,\delta t - \mathbf{p}\delta\mathbf{x}) = 2n\pi \frac{m_0}{\omega_0} c^2. \tag{20}$$

If we assume that $m_0c^2/\omega_0 = \hbar$ (a universal constant for all the clocks) we obtain just the kind of quantization that we need, for circuit integrals involving the translational momentum, $\mathbf{p}$ and the coordinates of the clocks, $\mathbf{x}$ (e.g., we can set $\delta t = 0$ and Eq. (20) reduces to a special case of Eq. (16)).

We see, then, that quantization of action can, at least in this special case, arise out of certain topological conditions, implied by the need for single-valuedness of the clock phases.

The above idea provides a starting point for a deeper understanding of the meaning of the quantum conditions, but it needs to be supplemented in two ways. First, we must consider the further fluctuations in the field, associated with the non-denumerable infinity of degrees of freedom. Second, we shall have to justify the assumption that the ratio m_0c^2/ω_0 in Eq. (20) is universal for all the local clocks and equal to $\hbar$.

To begin with, we recall that each local clock of a given level exists in a certain region of space and time, which is made up of still smaller regions, and so on without limit. We shall see that we can obtain the universability of the quantum of action, h, at all levels, if we assume that each of the above *sub-regions* contains an effective clock of a similar kind, related to the other effective clocks of its level in a similar way, and that this effective clock structure continues indefinitely with the analysis of space and time into sub-regions. We stress that this is only a preliminary assumption, and that later we will show that the notion of the indefinite continuation of the above clock structure can be given up.

To treat this problem, we introduce an ordered infinity of dynamic coordinates, x^l_i, and the conjugate momenta, p^l_i. The mean position of the ith clock at the lth level of size is represented by x^l_i, and p^l_i represents the corresponding momentum. To a first approximation the quantities of each level can be treated as collective coordinates of the next lower level set of variables; but this treatment cannot in general be completely exact because *each level will to some extent be influenced directly by all the other levels, in a way that cannot fully be expressed in terms of their effects on the next lower level quantities alone*. Thus, while each level is strongly correlated to the mean behaviour of the next lower level, it has some degree of independence.

The above discussion leads us to a certain ordering of the infinity of field variables that is indicated by the nature of the problem itself. In this ordering, we consider the series of quantities, x^l_i and p^l_i, defined above as, in principle, all independent coordinates and momenta which are, however, usually connected and correlated by suitable interactions.

We can now treat this problem by means of a canonical transformation. We introduce an action function, S, which depends on all the variables, x^l_i, of the infinity of clocks within clocks. As before, we then write

$$P^l_k = \frac{\partial S}{\partial x^l_k} \, (x^l_i \, . \, . \, . \, x^l_k \, . \, . \, .) \tag{21}$$

where l' represents all possible levels.

For the constants of the motion, we write

$$I_C = \sum_{k,l} \oint p^l_k \delta x^l_k = \delta S_C \tag{22}$$

where the integrals are carried over suitable contours.

Each of these constants of the motion is now built up out of

circuit integrals involving $p_i \delta x_i$, but as we saw, each one of these clocks must satisfy the phase condition $\oint p_\mu \delta_x^{\ \mu} = 2n\pi\hbar$ around any circuit. Hence the sum satisfies such a condition, which in turn must be satisfied not only in real circuits actually traversed by the clocks but also in any virtual circuit that is consistent with a given set of values for the constants of the motion. Because of fluctuations coming from lower levels, there is always the possibility that any clock may move on any one of the circuits in question; and unless the constants of the motion are determined such that $\delta S_c = 2n\pi\hbar$, clocks that reach the same position after having followed different randomly fluctuating paths will not, in general, agree with each other in their phases. Thus, the agreement of the phases of all clocks that reach the same point in space and time is equivalent to the quantum condition.

The self-consistency of the above treatment can now be verified in a further analysis, which also eliminates the need to introduce the special assumption that m_0c^2/ω_0 is universally constant and equal to $\hbar$ for all clocks. Each clock is now regarded as a composite system made up of smaller clocks. Indeed, to an adequate degree of approximation, each clock phase can be treated as a collective variable associated with the *space coordinates* of the smaller clocks (which then represent the inner structure of the clock in question). Now the action variable

$$I_c = \oint_c \sum_{k,l} p^l_{\ k} \delta q^l_{\ k}$$

is canonically invariant, in the sense that it takes the same form with every set of canonical variables, and is not changed in its value by a canonical transformation. Hence, if we transformed to the collective coordinates of any given level, we would still obtain the same kind of restriction I_c to integral multiples of h, even if I_c were expressed in terms of the collective variables. Thus

the collective variables of a given level will generally be subject to the same quantum restriction as those satisfied by the original variables of that level. In order that it be consistent for variables of a given level to be essentially equal to collective variables for the next lower level, it is sufficient that the variables of all levels be quantized in terms of the same unit of action, h. In this way, an overall consistent ordering of the non-denumerable infinity of variables becomes possible.

Each clock will then have a quantized value for the action variable, I_c, associated with its *inner motion* (i.e., of its phase changes). This inner motion was, however, assumed to be effectively that of a harmonic oscillator. Therefore, according to a well-known classical result, the inner energy is $E = J\omega_0/2\pi$; and since $J = Sh$, where S may be any integer, we obtain $E_0 = S\omega_0\hbar$.

Now E_0 is also the rest energy of the clock, so that $E_0 = m_0c^2$. Hence we obtain

$$\frac{m_0c^2}{\omega_0} = S\hbar. \tag{23}$$

This gives us, from Eq. (20),

$$\oint (E\delta t - \mathbf{p}\delta\mathbf{x}) = 2\pi \frac{m_0c^2}{\omega_0} n = nSh = nh; \tag{24}$$

and since, in general, S takes on arbitrary integral values, it is also an arbitrary integer. In this way, we eliminate the need for assuming separately, that m_0c^2/ω_0 is a universal constant, equal to $\hbar$.

To finish this stage of the development of the theory, we must show that the model discussed above leads to a fluctuation in the phase space of the variables of a given level, in accordance with that implied by Heisenberg's principle. In other words, the quantum of action, h, must also be shown to yield a correct

estimate of the limitation on the degree of self-determination of the quantities of any level.

To prove the above conjecture, we must note that each variable fluctuates because it depends on the lower-level quantities (of which it is a collective coordinate). The lower-level quantities can change their action variables only by discrete multiples of h. It is therefore not implausible that the domain of fluctuation of a given variable would be closely related to the size of the possible discrete changes in its constituent lower-level variables.

We shall prove the theorem stated above for the special case that all the degrees of freedom can be represented as coupled harmonic oscillators. This is a simplification of the real problem (which is non-linear). The real motions will consist of small systematic perturbations on top of an infinitely turbulent background. These systematic perturbations can be treated as collective coordinates, representing the overall behaviour of the constituent local clocks of a given level. In general, such a collective motion will take the form of a wavelike oscillation, which to a certain degree of approximation undergoes simple harmonic motion. Let us represent the action variables and angle variables of the nth harmonic oscillator by J_n and ϕ_n respectively. To the extent that the linear approximation is correct, J_n will be a constant of the motion, and ϕ_n will increase linearly with time according to the equation $\phi_n = \omega_n t + \phi_{0n}$, where ω_n is the angular frequency of the nth oscillator. J_n and ϕ_n will be related to the clock variables by a canonical transformation, such as (12). Because the generalized Bohr-Sommerfeld correlation (16) is invariant to a canonical transformation, it follows that $J_n = Sh$, where S is an integer. Moreover, the coordinates and momenta of these oscillators can be written as[29]

$$p_n = 2\sqrt{J_n}\cos\phi_n, \quad q_n = 2\sqrt{J_n}\sin\phi_n.$$

We now consider a higher level canonical set of variables, a

specific pair of which we denote by Q^l_i and π^l_i. In principle, these would be determined by the totality of all the other levels. To be sure, the next lower level will be the *main* one that enters into this determination; nevertheless, the others will still have *some* effect. Hence in accordance with our earlier discussions, we must regard π^l_i and Q^l_i as being, in principle, independent of any *given* set of lower-level variables, including, of course, those of the next lower level.

To the extent that the linear approximation is valid, we can write[30]

$$Q^l_i = \sum_n \alpha_{in} p_n = 2 \sum_n \alpha_{in} \sqrt{J_n} \cos\phi_n$$

$$\pi^l_i = \sum_n \beta_{in} q_n = 2 \sum_n \beta_{in} \sqrt{J_n} \sin\phi_n \qquad (25)$$

where α_{in} and β_{in} are constant coefficients, and where, as we recall, n is assumed to cover *all* levels other than l.

In order that it be consistent to suppose that Q^l_i and π^l_i are canonical conjugates, it is necessary that their Poisson bracket be unity or that

$$\sum_n \left(\frac{\partial \pi^l_i}{\partial J_n} \frac{\partial Q^l_i}{\partial \phi_n} - \frac{\partial \pi^l_i}{\partial \phi_n} \frac{\partial Q^l_i}{\partial J_n} \right) = 1.$$

With the aid of Eq. (25), this becomes

$$\Sigma \alpha_n \beta_n = 1. \qquad (26)$$

Eq. (25) implies a very complex motion for Q^l_i and π^l_i, for in a typical system of coupled oscillators the ω_n are in general all different and are not integral multiples of each other (except for

possible sets of measure zero). Thus, the motion will be a 'space-filling' (quasi-ergodic) curve in phase space, being a generalization of the two-dimensional Lissajou figures for perpendicular harmonic oscillators, with periods that are not rational multiples of each other.

During a time interval, τ, which is fairly long compared with the periods, $2\pi/\omega_n$, of the lower-level oscillators, the trajectory of Q^l_i and π^l_i in the phase space will, in essence, fill a certain region, even though the orbit is definite at all times. We shall now calculate the mean fluctuation of Q^l_i and π^l_i in this region by taking averages over the time, τ. Noting that $Q^l_i = \pi^l_i = 0$ for such averages, we have for these fluctuations,

$$(\Delta Q^l_i)^2 = 4 \sum_{mn} \alpha_m \alpha_n \sqrt{J_m J_n \cos\phi_m \cos\phi_n} = 2 \sum_m (\alpha_m)^2 J_m \quad (27)$$

$$(\Delta \pi^l_i)^2 = 4 \sum_{mn} \beta_m \beta_n \sqrt{J_m J_n \sin\phi_m \sin\phi_n} = 2 \sum_n (\beta_n)^2 J_n \quad (28)$$

where we have used the result that $\cos\delta_m \cos\delta_n = \sin\delta_m \sin\delta_n = 0$ for $m \neq n$ (except for the set of zero measure, mentioned above, in which ω_m and ω_n are rational multiples of each other).

We now suppose that all the oscillators are in their lowest states (with $J = h$) except for a set of zero measure. This set represents a denumerable number of excitations relative to the 'vacuum' state. Because of their small number, these make a negligible contribution to $(\Delta Q^l_i)^2$ and $(\Delta \pi^l_i)^2$.

We therefore set $J_n = h$ in Eq. (28) and obtain

$$(\Delta Q^l_i)^2 = 2 \sum_m (\alpha_m)^2 h; \quad (\Delta \pi^l_i)^2 = 2 \sum_n (\beta_n)^2 h.$$

We then use the Schwarz inequality

$$\sum_{mn} (\alpha_m)^2 (\beta_n)^2 \geqslant \left| \sum_m \alpha_m \beta_m \right|^2. \tag{29}$$

Combining the above with Eqs. (26), (27) and (28), we obtain

$$(\Delta\pi^l_i)^2 (\Delta Q^l_i)^2 \geqslant 4h^2. \tag{30}$$

The above relations are, in essence, those of Heisenberg. $\Delta\pi^l_i$ and ΔQ^l_i will effectively represent limitations on the degree of self-determination of the lth level, because all quantities of this level will evidently have to be averaged over periods of time long compared with $2\pi/\omega_n$. Thus, we have deduced Heisenberg's principle from the assumption of the quantum of action.

We note that Eq. (30) has already been obtained in section 10 in a very different way – by assuming simple random field fluctuations resembling those of particles undergoing Brownian motion. Hence, an infinity of lower-level variables satisfying the conditions that J_n is discrete and equal to the same constant, h, for all the variables, will yield a long-run pattern of motions that reproduces certain essential features of a random Brownian-type fluctuation.

We have thus completed our task of proposing a general physical model that explains the quantization rules along with the Heisenberg indeterminacy relations. But now, it can easily be seen that our basic physical model, involving an infinity of clocks within clocks, leaves room for fundamental changes, which would go outside the scope of the current quantum theory. To illustrate these possibilities, suppose that such a structure were to continue only for some characteristic time, τ_0, after which it would cease to exist and would be replaced by another kind of structure. Then, in processes that involve times much greater then τ_0, the clocks will still be restricted in essentially the same ways as before, since their motions would not significantly

be changed by the deeper substructure. Nevertheless, in processes involving times shorter than τ_0, there will be no reasons for such restrictions to apply, since the structure is no longer the same. In this way, we see how J_n will be restricted to discrete values in certain levels, while they are not necessarily restricted in this way in other levels.

For levels in which J_n are not restricted to being multiples of h, Eq. (30) for the fluctuation of π^l_i and Q^l_i need no longer apply. In place of h, there will appear a quantity, J_m, the *mean* action associated with the levels in question. In addition, averages of ($\cos\phi_m$ $\cos\phi_n$) may cease to be negligible, because the times are too short. Thus, there is room for every conceivable kind of change in the rules for determining J_n and in those determining the magnitudes of fluctuation associated with a given level. Nevertheless, in the quantum levels the usual rules will be valid to a very high degree of approximation.

13 DISCUSSION OF EXPERIMENTS TO PROBE SUB-QUANTUM LEVEL

We are now ready to discuss, at least in general terms, the conditions under which it might be possible to test for a sub-quantum level experimentally, and in this way to complete our answers to the criticisms of the suggestion of hidden variables made by Heisenberg and Bohr.

We first recall that the proof of Heisenberg's relations, concerning the maximum possible accuracy of measurement of canonically conjugate variables, made use of the implicit assumption that measurements must involve only processes satisfying the general laws of the current quantum theory. Thus, in the well-known example of the gamma-ray microscope, he supposed that the position of an electron was to be measured by scattering a gamma ray from the particle in question into a lens and on to a photographic plate. This scattering is essentially a

case of the Compton effect; and the proof of Heisenberg's principle depended essentially on the assumption that the Compton effect satisfies the laws of the quantum theory (i.e., conservation of energy and momentum in an 'indivisible' scattering process, wavelike character of the scattered quantum as it goes through the lens, and incomplete determinism of the particle-like spot on the photographic plate). More generally, any such proof must be based on the assumption that at every stage the process of measurement will satisfy the laws of the quantum theory. Thus to suppose that Heisenberg's principle has a universal validity is, in the last analysis, the same as to suppose that the general laws of the quantum theory are universally valid. But this supposition is now expressed in terms of the *external relations* of the particle to a measuring apparatus, and not in terms of the inner characteristics of the particle itself.

In our point of view, Heisenberg's principle should not be regarded as *primarily* an external relation, expressing the impossibility of making measurements of unlimited precision in the quantum domain. Rather, it should be regarded as basically an expression of the incomplete degree of *self-determination* characteristic of all entities that can be defined in the quantum-mechanical level. It follows that if we measure such entities, we will also use processes taking place in the quantum-mechanical level, so that the process of measurement will have the same limits on its degree of self-determination as every other process in this level. It is rather as if we were measuring Brownian motion with microscopes that were subject to the same degree of random fluctuation as that of the systems that we were trying to observe.

As we saw in sections 10 and 12, however, it is possible and indeed rather plausible to suppose that sub-quantum-mechanical processes involving very small intervals of time and space will not be subject to the same limitations of their degree of self-determination as those of quantum-mechanical

processes. Of course, these sub-quantum processes will very probably involve basically new kinds of entities as different from electrons, protons, etc., as the latter are from macroscopic systems. Hence, entirely new methods would have to be developed to observe them (as new methods also had to be developed to observe atoms, electrons, neutrons, etc.). These methods will depend on using interactions involving sub-quantum laws. In other words, just as the 'gamma-ray microscope' was based on the existence of the Compton effect, a 'sub-quantum microscope' would be based on new effects, not limited in their degree of self-determination by the laws of the quantum theory. These effects would then make possible a correlation between an observable large-scale event and the state of some sub-quantum variable that is more accurate than is permitted in Heisenberg's relations.

Of course, one does not expect, in the way described above, to actually determine all the sub-quantum variables and thus to predict the future in full detail. Rather, one aims only by a few crucial experiments to show that the sub-quantum level is there, to investigate its laws, and to use these laws to explain and predict the properties of higher-level systems in more detail, and with greater precision, than the current quantum theory does.

To treat this question in more detail, we now recall a conclusion of the previous section, i.e. that if in lower levels the action variable should be divisible in units smaller than h, then the limits on the degree of self-determination of these lower levels can be less severe than those given by Heisenberg's relations. Thus, there may well be relatively divisible and self-determined processes going on at lower levels. But how can we observe them on our level?

To answer the above question, we refer to Eq. (25), which indicates in typical case how the variables of a given level depend to some extent on *all* the lower-level variables. Thus if π^l_i and Q^l_i represent the classical level, then they would, in general, be

determined *mainly* by the p^l_i and q^l_i of the quantum level; but there would be *some* effects due to sub-quantum levels. Usually these would be quite small. However, in special cases (e.g., with special arrangements of apparatus) the π^l_i and Q^l_i might depend significantly on the p^l_i and q^l_i of a sub-quantum level. Of course, this would mean the coupling of some new kind of sub-quantum process (as yet unknown, but perhaps to be discovered later) to the observable large-scale classical phenomena. Such a process would presumably involve high frequencies and therefore high energies, but in a new way.

Even when the effects of the sub-quantum level on π^l_i and Q^l_i are small, they are not identically zero. Thus, room is created for testing for such effects by doing old kinds of experiments with extremely high precision. For example, the relation $J_n = nh$ was obtained in Eq. (24) only if the quantum of action was supposed to be universally equal to h (at all levels). Sub-quantum deviations from this rule would therefore be reflected in the classical level as a minute error in the relation $E = nh\nu$ for a harmonic oscillator. In this connection, recall that in classical theory there is no special relation between energy and frequency at all. This situation may to some extent be restored in the sub-quantum domain. As a result, one would discover a small fluctuation in the relation between E_n and $nh\nu$. For example, one would have

$$E_n = nh\nu + \in$$

where $\in$ is a very small randomly fluctuating quantity (which gets larger and larger as we go to higher and higher frequencies). To test for such a fluctuation, one could perform an experiment in which the frequency of a light beam was observed to an accuracy, $\nabla\nu$. If the observed energy fluctuated by more than $\hbar\nabla\nu$, and if no source could be found for the fluctuation in the quantum level, this experiment could be taken as an indication of sub-quantum fluctuations.

With this discussion, we complete our answer to the criticisms of Bohr and Heisenberg, who argue that a deeper level of hidden variables in which the quantum of action was divisible could never be revealed in any experimental phenomena. This also means that there are no valid arguments justifying the conclusion of Bohr that the concept of the detailed behaviour of matter as a unique and self-determining process must be restricted to the classical level only (where one can observe fairly directly the behaviour of the large-scale phenomena). Indeed we are also able to apply such notions in a sub-quantum level, whose relations with the classical level are relatively indirect, and yet capable, in principle, of revealing the existence and the properties of the lower level through its effects on the classical level.

Finally, we consider the paradox of Einstein, Rosen and Podolsky. As we saw in section 4, we can easily explain the peculiar quantum-mechanical correlations of distant systems by supposing hidden interactions between such systems, carried in the sub-quantum level. With an infinity of fluctuating field variables in this lower level, there are ample motions going on that might explain such a correlation. The only real difficulty is to explain how the correlations are maintained if, while the two systems are still flying apart, we suddenly change the variable that is going to be measured by changing the measuring apparatus for one of the systems. How, then, does the far-away system receive instantaneously a 'signal' showing that a new variable is going to be measured, so that it will respond accordingly?

To answer this question, we first note that the characteristic quantum-mechanical correlations have been observed experimentally with distant systems only when the various pieces of observing apparatus have been standing around so long that there has been plenty of opportunity for them to come to equilibrium with the original system through sub-quantum-mechanical interactions.[31] For example, in the case of the molecule described in section 4, there would be time for many

impulses to travel back and forth between the molecule and the spin-measuring devices, even before the molecule disintegrated. Thus, the actions of the molecule could be 'triggered' by signals from the apparatus, so that it would emit atoms with spins already properly lined up for the apparatus that was going to measure them.

In order to test the essential point here, one would have to use measuring systems that were changed rapidly compared with the time needed for a signal to go from the apparatus to the observed system and vice versa. What would really happen if this were done is not yet known. It is possible that the experiments would disclose a failure of the typical quantum-mechanical correlations. If this were to happen, it would be a proof that the basic principles of the quantum are breaking down here, for the quantum theory could not explain such a behaviour, while a sub-quantum theory could quite easily explain it as an effect of the failure of sub-quantum connections to relate the systems rapidly enough to guarantee correlations when the apparatus was changed very suddenly.

On the other hand, if the predicted quantum-mechanical correlations are still found in such a measurement, this is no proof that a sub-quantum level does not exist, for even the mechanical device that suddenly changes the observing apparatus must have sub-quantum connections with all parts of the system, and through these a 'signal' might still be transmitted to the molecule that a certain observable was eventually going to be measured. Of course, we would expect that at some level of complexity of the apparatus, the sub-quantum connections would cease to be able to do this. Nevertheless, in the absence of a more detailed sub-quantum-mechanical theory, where this will happen cannot be known a priori. In any case, the results of such an experiment would surely be very interesting.

14 CONCLUSION

In conclusion, we have carried the theory far enough to show that we can explain the essential features of the quantum mechanics in terms of a sub-quantum-mechanical level involving hidden variables. Such a theory is capable of having a new experimental content, especially in connection with the domain of very short distances and very high energies, where there are new phenomena not very well treated in terms of present theories (and also in connection with the experimental verification of certain features of the correlations of distant systems). Moreover, we have seen that this type of theory opens up new possibilities for elimination of divergence in present theories also associated with the domain of short distances and high energies. (For example, as shown in section 10, the breakdown of Heisenberg's principle for short time could eliminate the infinite effects of quantum fluctuations.)

Of course, the theory as developed here is far from complete. It is necessary at least to show how one obtains the many-body Dirac equation for fermions, and the usual wave equations for bosons. On these problems much progress has been made but there is no space to enter into a discussion of them here. In addition, further progress is being made on the systematic treatment of the new kinds of particles (mesons, hyperons, etc.) in terms of our scheme. All of this will be published later and elsewhere.

Nevertheless, even in its present incomplete form, the theory does answer the basic criticisms of those who regarded such a theory as impossible, or who felt that it could never concern itself with any real experimental problems. At the very least, it does seem to have promise of being able to throw some light on a number of such experimental problems, as well as on those arising in connection with the lack of internal consistency of the current theory.

For the reasons described above, it seems that some consideration of theories involving hidden variables is at present needed to help us to avoid dogmatic preconceptions. Such preconceptions not only restrict our thinking in an unjustifiable way but also similarly restrict the kinds of experiments that we are likely to perform (since a considerable fraction of all experiments is, after all, designed to answer questions raised in some theory). Of course, it would be equally dogmatic to insist that the usual interpretation has already exhausted all of its possible usefulness for these problems. What is necessary at the present time is that many avenues of research be pursued, since it is not possible to know beforehand which is the right one. In addition, the demonstration of the possibility of theories of hidden variables may serve in a more general philosophical sense to remind us of the unreliability of conclusions based on the assumption of the complete universality of certain features of a given theory, however general their domain of validity seems to be.

5

QUANTUM THEORY AS AN INDICATION OF A NEW ORDER IN PHYSICS

Part A: The Development of New Orders as Shown Through the History of Physics

1 INTRODUCTION

Revolutionary changes in physics have always involved the perception of new order and attention to the development of new ways of using language that are appropriate to the communication of such order.

We shall start this chapter with a discussion of certain features of the history of the development of physics that can help give some insight into what is meant by perception and communication of a new order. We shall then go on in the next chapter to present our suggestions regarding the new order that is indicated by the consideration of the quantum theory.

In ancient times, there was only a vague qualitative notion of order in nature. With the development of mathematics, notably arithmetic and geometry, the possibility arose for defining forms and ratios more precisely, so that, for example, one could describe the detailed orbits of planets, etc. However, such detailed mathematical descriptions of the motions of the planets and other heavenly bodies implied certain general notions of order. Thus, the Ancient Greeks thought that the Earth was at the centre of the universe, and that surrounding the Earth were spheres, which approached the ideal perfection of celestial matter as one got further and further away from the Earth. The perfection of celestial matter was supposed to be revealed in circular orbits, which were regarded as the most perfect of all geometrical figures, while the imperfection of earthly matter was thought to be shown in its very complicated and apparently arbitrary movements. Thus, the universe was both perceived and discussed in terms of a certain overall order; i.e., the order of degrees of perfection, which corresponded to the order of distance from the centre of the Earth.

Physics as a whole was understood in terms of notions of order closely related to those described above. Thus, Aristotle compared the universe to a living organism, in which each part had its proper place and function, so that all worked together to make a single whole. Within this whole, an object could move only if there was a force acting on it. Force was thus thought of as a *cause* of motion. So the order of movement was determined by the order of causes, which in turn depended on the place and function of each part in the whole.

The general way of perceiving and communicating order in physics was, of course, not at all in contradiction with common experience (in which, for example, movement is possible as a rule only when there is a force which overcomes friction). To be sure, when more detailed observations were made on the planets, it was found that their orbits are not actually perfect

circles, but this fact was accommodated within the prevailing notions of order by considering the orbits of planets as a superposition of *epicycles*, i.e., circles within circles. Thus, one sees an example of the remarkable capacity for *adaptation* within a given notion of order, adaptation that enables one to go on perceiving and talking in terms of essentially fixed notions of this kind in spite of factual evidence that might at first sight seem to necessitate a thorough-going change in such notions. With the aid of such adaptations, men could for thousands of years look at the night sky and see epicycles there, almost independently of the detailed content of their observations.

It seems clear, then, that a basic notion of order, such as was expressed in terms of epicycles, could never be decisively contradicted, because it could always be adjusted to fit the observed facts. But eventually, a new spirit arose in scientific research, which led to the questioning of the *relevance* of the old order, notably by Copernicus, Kepler, and Galileo. What emerged from such questioning was in essence the proposal that the difference between earthly and celestial matter is not actually very significant. Rather, it was suggested that a key difference is between the motion of matter in empty space and its motion in a viscous medium. The basic laws of physics should then refer to the motion of matter in empty space, rather than to its motion in a viscous medium. Thus, Aristotle was right to say that matter as commonly experienced moved only under the action of a force, but he was wrong in supposing that this common experience was relevant to the fundamental laws of physics. From this it followed that the key difference between celestial and earthly matter was not in its degree of perfection but rather in that celestial matter generally moves without friction in a vacuum, whereas terrestrial matter moves with friction in a viscous medium.

Evidently, such notions were not generally compatible with the idea that the universe is to be regarded as a single living

organism. Rather, in a fundamental description, the universe now had to be regarded as analysable into separately existing parts or objects (e.g. planets, atoms, etc.) each moving in a void or vacuum. These parts could work together in interaction more or less as do the parts of a machine, but could not grow, develop, and function in response to ends determined by an 'organism as a whole'. The basic order for description of movement of the parts of this 'machine' was taken to be that of successive positions of each constituent object at successive moments of time. Thus, a new order became relevant, and a new usage of language had to be developed for the description of this new order.

In the development of new ways of using language, the Cartesian coordinates played a key part. Indeed, the very word 'coordinate' implies a function of *ordering*. This ordering is achieved with the aid of a grid. This is constituted of three perpendicular sets of uniformly spaced lines. Each set of lines is evidently an order (similar to the order of the integers). A given curve is then determined by a *coordination* among the X, the Y and the Z orders.

Coordinates are evidently not to be regarded as natural objects. Rather, they are merely convenient forms of description set up by us. As such, they have a great deal of arbitrariness or conventionality (e.g., in orientation, scale, orthogonality, etc., of coordinate frames). Despite this kind of arbitrariness, however, it is possible, as is now well known, to have a non-arbitrary general law expressed in terms of coordinates. This is possible if the law takes the form of a relationship that remains *invariant* under changes in the arbitrary features of the descriptive order.

To use coordinates is in effect to order our attention in a way that is appropriate to the mechanical view of the universe, and thus similarly to order our perception and our thinking. It is clear, for example, that though Aristotle very probably would have understood the meaning of coordinates, he would

have found them of little or no significance for his aim of understanding the universe as an organism. But once men were ready to conceive of the universe as a machine, they would naturally tend to take the order of coordinates as a universally relevant one, valid for all basic descriptions in physics.

Within this new Cartesian order of perception and thinking that had grown up after the Renaissance, Newton was able to discover a very general law. It may be stated thus: 'As with the order of movement in the fall of an apple, so with that of the Moon, and so with *all*.' This was a new perception of law, i.e., universal harmony in the order of nature, as described in detail through the use of coordinates. Such perception is a flash of very penetrating insight, which is basically *poetic*. Indeed, the root of the word 'poetry' is the Greek 'poiein', meaning 'to make' or 'to create'. Thus, in its most original aspects, science takes on a quality of poetic communication of creative perception of new order.

A somewhat more 'prosaic' way of putting Newton's insight is to write $A{:}B{::}C{:}D$. That is to say: 'As the successive positions A, B of the apple are related, so are the successive positions C, D of the Moon.' This constitutes a generalized notion of what may be called *ratio*. Here, we take ratio in its broadest meaning (e.g., in its original Latin sense) which includes all of *reason*. Science thus aims to discover universal ratio or reason, which includes not only numerical ratio or proportion ($A/B = C/D$), but also general qualitative similarity.

Rational law is not restricted to an expression of *causality*. Evidently, reason, in the sense that is meant here, goes far beyond causality, which latter is a special case of reason. Indeed, the basic form of causality is: 'I do a certain action X and cause something to happen.' A causal law then takes the form: 'As with such causal actions of mine, so with certain processes that can be observed in nature.' Thus, a causal law provides a certain *limited kind* of reason. But, more generally, a rational explanation takes

the form: ‘As things are related in a certain idea or concept, so they are related in fact.’

It is clear from the preceding discussion that in finding a new structure of reason or rationality, it is crucial *first* to discern relevant differences. To try to find a rational connection between irrelevant differences leads to arbitrariness, confusion, and general sterility (e.g., as with epicycles). So we have to be ready to drop our assumptions as to what are the relevant differences, though this has often seemed to be very difficult to do, because we tend to give such high psychological value to familiar ideas.

2 WHAT IS ORDER?

Thus far, the term order has been used in a number of contexts that are more or less known to everyone, so that its meaning can be seen fairly clearly from its usage. The notion of order, however, is evidently relevant in much broader contexts. Thus, we do not restrict order to some regular arrangement of objects or forms in lines or in rows (e.g., as with grids). Rather, we can consider much more general orders, such as the order of growth of a living being, the order of evolution of living species, the order of society, the order of a musical composition, the order of painting, the order which constitutes the meaning of communication, etc. If we wish to inquire into such broader contexts, the notions of order to which we have referred earlier in this chapter will evidently no longer be adequate. We are therefore led to the general question: ‘What is order?’

The notion of order is so vast and immense in its implications, however, that it cannot be defined in words. Indeed, the best we can do with order is to try to ‘point to it’ tacitly and by implication, in as wide as possible a range of contexts in which this notion is relevant. We all know order implicitly, and such ‘pointing’ can perhaps communicate a general and overall meaning of order without the need for a precise verbal definition.

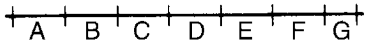

Figure 5.1

To begin to understand order in such a general sense, we may first recall that in the development of classical physics the perception of a new order was seen to involve the discrimination of new relevant differences (positions of objects at successive moments of time) along with new similarities that are to be found in the differences (similarity of 'ratios' in these differences). It is being suggested here that this is the seed or nucleus of a very general way of perceiving order, i.e., *to give attention to similar differences and different similarities.*[1]

Let us illustrate these notions in terms of a geometric curve. To simplify the example, we shall approximate the curve by a series of straight-line segments of equal length. We begin with a straight line. As shown in Figure 5.1, the segments in a straight line all have the same direction, so that their only difference is in the position. The difference between segment *A* and segment *B* is thus a space displacement which is similar to the difference between *B* and *C*, and so on. We may therefore write

$$A{:}B{::}B{:}C{::}C{:}D{::}D{:}E.$$

This expression of 'ratio' or 'reason' may be said to define a curve of *first class*, i.e., a curve having only one independent difference.

Next, we consider a circle, as illustrated in Figure 5.2. Here,

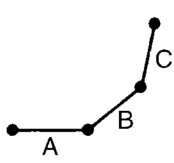

Figure 5.2

the difference between A and B is in direction as well as in position. Thus, we have a curve with two independent differences – which is therefore one of *second class*. However, we still have a single 'ratio' in the differences, A:B::B:C.

Now we come to a helix. Here, the angle between lines can turn in a third dimension. Thus, we have a curve of *third class*. It, too, is determined by a single ratio, A:B::B:C.

Thus far we have considered various *kinds* of similarities in the differences, to obtain curves of first, second, third classes, etc. However, in each curve, the similarity (or ratio) between successive steps remains invariant. Now we can call attention to curves in which *this similarity is different* as we go along the curve. In this way, we are led to consider not only *similar differences* but also *different similarities of the differences*.

We can illustrate this notion by means of a curve which is a chain of straight lines in different directions (see Figure 5.3). On the first line (*ABCD*), we can write

$$A:B:^{S_1}::B:C.$$

The symbol S_1 stands for 'the first kind of similarity', i.e., in direction along the line (*ABCD*). Then we write for the lines (*EFG*) and (*HIJ*)

$$E:F^{S_2}::F:G \text{ and } H:I^{S_3}::I:J$$

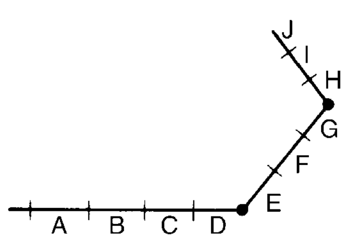

Figure 5.3

where S_2 stands for 'the similarity of the second kind' and S_3 for 'the similarity of the third kind'.

We can now consider the difference of successive similarities (S_1, S_2, S_3, . . .) as a *second degree of difference*. From this, we can develop a *second degree of similarity in these differences*. $S_1:S_2::S_2:S_3$.

By thus introducing what is in effect the beginning of a hierarchy of similarities and differences, we can go on to curves of arbitrarily high degrees of order. As the degrees become indefinitely high, we are able to describe what have commonly been called 'random' curves – such as those encountered in Brownian motion. This kind of curve is not determined by any finite number of steps. Nevertheless, it would not be appropriate to call it 'disordered', i.e., *having no order whatsoever*. Rather, it has a certain kind of order which is of an indefinitely high degree.

In this way, we are led to make an important change in the general language of description. We no longer use the term 'disorder' but instead we distinguish between different degrees of order (so that, for example, there is an unbroken gradation of curves, beginning with those of first degree, and going on step by step to those that have generally been called 'random').

It is important to add here that order is not to be identified with *predictability*. Predictability is a property of a special kind of order such that a few steps determine the whole order (i.e., as in curves of low degree) – but there can be complex and subtle orders which are not in essence related to predictability (e.g. a good painting is highly ordered, and yet this order does not permit one part to be predicted from another).

3 MEASURE

In developing the notion of an order of high degree, we have tacitly brought in the idea that each sub-order has a *limit*. Thus, in Figure 5.3 the order of the line *ABC* reaches its limit at the end of the segment C. Beyond this limit is another order, *EFG*, and so

on. So, the description of a hierarchic order of high degree generally involves the notion of limit.

It is significant to note here that in ancient times the most basic meaning of the word 'measure' was 'limit' or 'boundary'. In this sense of the word, each thing could be said to have its appropriate measure. For example, it was thought that when human behaviour went beyond its proper bounds (or measure) the result would have to be tragedy (as was brought out very forcefully in Greek dramas). Measure was indeed considered to be essential to the understanding of the good. Thus, the origin of the word 'medicine' is the Latin 'mederi', which means 'to cure' and which was derived from a root meaning 'measure'. This implied that to be healthy was to have everything in a right measure, in body and mind. Similarly, wisdom was equated with *moderation* and *modesty* (whose common root is also derived from measure), thus suggesting that the wise man is the one who keeps everything in the right measure.

To illustrate this meaning of the word 'measure' in physics, one could say that 'the measure of water' is between 0° and 100°C. In other words, measure primarily gives the limits of qualities or of orders of movement and behaviour.

Of course, measure has to be *specified* through proportion or ratio, but, in terms of the ancient notion, this specification is understood as secondary in significance to the boundary or limit which is thus specified; and here one can add that in general this specification need not even be in terms of quantitative proportion, but rather can be in terms of quantitative reason (e.g., in a drama the proper measure of human behaviour is specified in qualitative terms rather than by means of numerical ratios).

In the modern usage of the word 'measure', the aspect of quantitative proportion or numerical ratio tends to be emphasized much more heavily than it was in ancient times. Yet even here the notion of boundary or limit is still present, though in the background. Thus, to set up a *scale* (e.g., of length) one

must establish divisions which are in effect *limits* or *boundaries* of ordered segments.

By giving attention in this way to older meanings of words along with their current meanings, one can obtain a certain insight into the full significance of a general notion, such as measure, which is not provided by considering only more specialized modern meanings that have been developed in various forms of scientific, mathematical and philosophical analysis.

4 STRUCTURE AS A DEVELOPMENT FROM ORDER AND MEASURE

If we consider measure in the broad sense indicated above, we can see how this notion works together with that of order. Thus, as shown in Figure 5.4 any linear order within a triangle (such as the line *FG*) is bounded (i.e., measured) by the lines *AB*, *BC*, and *CA*. Each of these lines is itself an order of segments, which is limited (i.e., measured) by the other lines. The shape of the triangle is then described in terms of certain proportions between the sides (relative lengths).

The consideration of the working together of order and measure in ever-broader and more complex contexts leads to the notion of *structure*. As the Latin root 'struere' indicates, the essential meaning of the notion of structure is to build, to grow, to evolve. This word is now treated as a noun, but the Latin suffix 'ura' originally meant 'the action of doing something'. To

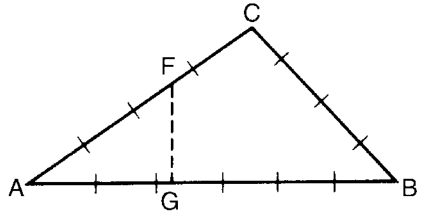

Figure 5.4

emphasize that we are not referring mainly to a ‘finished product’ or to an ultimate result, we may introduce a new verb, *to structate*, meaning ‘to create and dissolve what are now called structures’.

Structation is evidently to be described and understood through order and measure. For example, consider the structation (construction) of a house. The bricks are arranged in an order and in a measure (i.e., within limits) to make walls. The walls are similarly ordered and measured to make rooms, the rooms to make a house, the houses to make streets, the streets to make cities, etc.

Structation thus implies a *harmoniously organized* totality of order and measures, which is both *hierarchic* (i.e., built on many levels) and *extensive* (i.e., ‘spreading out’ on each level). The Greek root of the word ‘organize’ is ‘ergon’ which is based on a verb meaning ‘to work’. So one may think of all aspects of a structure as ‘working together’ in a coherent way.

Evidently, this principle of structure is universal. For example, living beings are in a continual movement of growth and evolution of structure, which is highly organized (e.g., molecules work together to make cells, cells work together to make organs, organs to make the individual living being, individual living beings a society, etc). Similarly, in physics, we describe matter as constituted of moving particles (e.g. atoms) which work together to make solids, liquids, or gaseous structures, which similarly make larger structures, going on up to planets, stars, galaxies, galaxies of galaxies, etc. Here, it is important to emphasize the *essentially dynamic* nature of structation, in inanimate nature, in living beings, in society, in human communication, etc. (e.g., consider the structure of a language, which is an organized totality of ever-flowing movement).

The kinds of structures that can evolve, grow, or be built are evidently limited by their underlying order and measure. New order and measure make possible the consideration of new kinds

of structure. A simple example of this can be taken from music. Here, the structures that can be worked with depend on the order of the notes and on certain measures (scale, rhythm, time, etc.). New orders and measures evidently make possible the creation of new structures in music. In this chapter, we are inquiring into how new orders and measures in physics may similarly make possible the consideration of new structures in physics.

5 ORDER, MEASURE AND STRUCTURE IN CLASSICAL PHYSICS

As has already been indicated in general terms, classical physics implies a certain basic descriptive order and measure. This may be characterized as the use of certain Cartesian coordinates and by the notion of universal and absolute order of time, independent of that of space. This further implies the absolute character of what may be called *Euclidean* order and measure (i.e., that characteristic of Euclidean geometry). With this order and measure, certain structures are possible. In essence, these are based on the quasi-rigid body, considered as a constituent element. The general characteristic of classical structure is just the analysability of everything into separate parts, which are either small, quasi-rigid bodies, or their ultimate idealization as extensionless particles. As pointed out earlier, these parts are considered to be working together in interaction (as in a machine).

The laws of physics, then, express the reason or ratio in the movements of all the parts, in the sense that the law relates the movement of each part to the configuration of all the other parts. This law is deterministic in form, in that the only contingent features of a system are the initial positions and velocities of all its parts. It is also *causal*, in that any external disturbance can be treated as a *cause*, which produces a specifiable *effect* that can in principle be propagated to every part of the system.

With the discovery of Brownian motion, one obtained

phenomena that *at first sight* seemed to call the whole classical scheme of order and measure into question, for movements were discovered which were what have been called here 'order of unlimited degree', not determined by a few steps (e.g., initial positions and velocities). However, this was explained by supposing that whenever we have Brownian motion this is due to very complex impacts from smaller particles or from randomly fluctuating fields. It is then further supposed that when these additional particles and fields are taken into account, the total law will be deterministic. In this way, classical notions of order and measure can be *adapted*, so as to *accommodate* Brownian motion, which would at least on the face of the matter seem to require description in terms of a very different order and measure.

The possibility of such adaptation evidently depends, however, on an assumption. Indeed, even if we can trace *some* kinds of Brownian motion (e.g. of smoke particles) back to impacts of smaller particles (atoms), this does not prove that the laws are ultimately of the classical, deterministic kind – for it is always possible to suppose that basically all movements are to be described *from the very outset* as Brownian motion (so that the apparently continuous orbits of large objects such as planets would only be approximations to an actually Brownian type of path). Indeed, mathematicians (notably Wiener) have both implicitly and explicitly worked in terms of Brownian motion as a basic description[2] (not explained as a result of impacts of finer particles). Such an idea would in effect bring in a new kind of order and measure. If it were pursued seriously, this would imply a change of possible structures that would perhaps be as great as that implied by the change from Ptolemaic epicycles to Newtonian equations of motion. Actually, this line was not seriously pursued in classical physics. Nevertheless, as we shall see later, it may be useful to give some attention to it, to obtain a new insight into the possible limits of relevance of the theory of

relativity, as well as into the relationship between relativity and quantum theory.

6 THE THEORY OF RELATIVITY

One of the first real breaks in classical notions of order and measure came with the theory of relativity. It is significant to point out here that the root of the theory of relativity was probably in a question that Einstein asked himself when he was fifteen years old: 'What would happen if one were to move at the speed of light and look in a mirror?' Evidently, one would see nothing because the light from one's face would never reach the mirror. This led Einstein to feel that light is somehow basically different from other forms of motion.

From our more modern vantage point, we can emphasize this difference yet more by considering the atomic structure of the matter out of which we are constituted. If we went faster than light, then, as a simple calculation shows, the electromagnetic fields that hold our atoms together would be left behind us (as the waves produced by an aeroplane are left behind it when it goes faster than sound). As a result, our atoms would disperse, and we would fall apart. So it would make no sense to suppose that we could go faster than light.

Now, a basic feature of the classical order and measure of Galileo and Newton is that one can in principle catch up with and overtake any form of motion, as long as the speed is finite. However, as has been indicated here, it leads to absurdities to suppose that we can catch up with and overtake light.

This perception that light should be considered to be different from other forms of motion is similar to Galileo's seeing that empty space and a viscous medium are different with regard to the expression of the laws of physics. In Einstein's case, one sees that the speed of light is not a possible speed for an object. Rather, it is like a horizon that cannot be reached. Even though

we seem to move toward the horizon, we never get any closer. As we move toward a light ray, we never get closer to its speed. Its speed always remains the same, *c*, relative to us.

Relativity introduces new notions concerning the order and measure of time. These are no longer *absolute*, as was the case in Newtonian theory. Rather, they are now *relative* to the speed of a coordinate frame. This relativity of time is one of the radically new features of Einstein's theory.

A very significant change of language is involved in the expression of the new order and measure of time plied by relativistic theory. The speed of light is taken not as a possible speed of an *object*, but rather as the maximum speed of propagation of a *signal*. Heretofore, the notion of signal had played no role in the underlying general descriptive order of physics, but now it is playing a key role in this context.

The word 'signal' contains the word 'sign', which means 'to point to something' as well as 'to have significance'. A signal is indeed a kind of *communication*. So in a certain way, significance, meaning, and communication became relevant in the expression of the general descriptive order of physics (as did also information, which is, however, only a *part* of the content or meaning of a communication). The full implications of this have perhaps not yet been realized, i.e., of how certain very subtle notions of order going far beyond those of classical mechanics have tacitly been brought into the general descriptive framework of physics.

The new order and measure introduced in relativity theory implies new notions of structure in which the idea of a rigid body can no longer play a key role. Indeed, it is not possible in relativity to obtain a consistent definition of an extended rigid body, because this would imply signals faster than light. In order to try to accommodate this new feature of relativity theory within the older notions of structure, physicists were driven to the notion of a particle that is an extensionless point but, as is well known, this effort has not led to generally satisfactory

results because of the infinite fields implied by point particles. Actually, relativity implies that neither the point particles nor the quasi-rigid body can be taken as primary concepts. Rather, these have to be expressed in terms of *events* and *processes*.

For example, any localizable structure may be described as a *world tube* (see Figure 5.5). Inside this tube *ABCD*, a complex process is going on, as indicated by the many lines within the world tube. It is not possible consistently to analyse movement within this tube in terms of 'finer particles' because these, too, would have to be described as tubes, and so on *ad infinitum*. Moreover, each tube is brought into existence from a broader background or context, as indicated by the lines preceding *AD*, while eventually it dissolves back into the background, as indicated by the lines following *BC*. Thus, the 'object' is an abstraction of a relatively invariant form. That is to say, it is more like a pattern of movement than like a solid separate thing that exists autonomously and permanently.[3]

However, thus far the problem of obtaining a *consistent* description of such a world tube has not been solved. Einstein did in fact very seriously try to obtain such a description in terms of a unified field theory. He took the total field of the whole universe as a primary description. This field is continuous and indivisible.

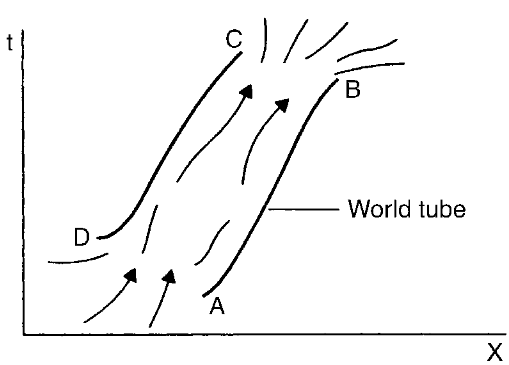

Figure 5.5

Particles are then to be regarded as certain kinds of abstraction from the total field, corresponding to regions of very intense field (called singularities). As the distance from the singularity increases (see Figure 5.6), the field gets weaker, until it merges imperceptibly with the fields of other singularities. But nowhere is there a break or a division. Thus, the classical idea of the separability of the world into distinct but interacting parts is no longer valid or relevant. Rather, we have to regard the universe as *an undivided and unbroken whole*. Division into particles, or into particles and fields, is only a crude abstraction and approximation. Thus, we come to an order that is radically different from that of Galileo and Newton – the order of *undivided wholeness*.

In formulating his description in terms of a unified field, Einstein developed *the general theory of relativity*. This involved a number of further new notions of order. Thus, Einstein considered arbitrary sets of *continuous curves* as allowable coordinates, so that he worked in terms of *curvilinear order and measure* rather than in terms of *rectilinear order and measure* (though of course such curves are locally still approximately rectilinear over short enough distances). Through the principles of equivalence of gravitation and acceleration and through the use of the Christoffel symbol Γ^{a}_{bc} which mathematically describes the local rate of 'turning' of the curvilinear coodinates, Einstein was able to relate this curvilinear order and measure to the *gravitational field*. This relationship implied the need for *non-linear equations*, i.e., equations whose solution cannot simply be added together to yield new solutions. This non-linear feature of the equations was of crucial significance not only in that it in principle opened up the possibility of solutions with stable particle-like singularities

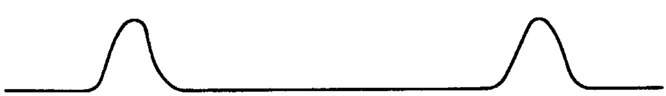

Figure 5.6

of the type described above (which are impossible with linear equations), but also in that it had very important implications with regard to the question of *analysis* of the world into distinct but interacting components.

In discussing this question, it is useful first to note that the word 'analysis' has the Greek root 'lysis', which is also the root of the English 'loosen' and which means 'to break up or dissolve'. Thus, a chemist can break up a compound into its basic elementary constituents, and then he can put these constituents back together again, and thus *synthesize* the compound. The words 'analysis' and 'synthesis' have, however, come to refer not merely to actual physical or chemical operations with *things*, but also to similar operations carried out in *thought*. Thus, it may be said that classical physics is expressed in terms of a *conceptual analysis* of the world into constituent parts (such as atoms or elementary particles) which are then conceptually put back together to 'synthesize' a total system, by considering the interactions of these parts.

Such parts may be separate in space (as are the atoms), but they may also involve more abstract notions that do not imply separation in space. For example, in a wave field that satisfies a linear equation, it is possible to choose a set of 'normal modes' of motion of the entire field, each of which can be regarded as moving independently of the others. One can then *think* of the field analytically as if every possible form of wave motion were constituted out of a sum of such independent 'normal modes'. Even if the wave field satisfies a non-linear equation, one can in a certain approximation still analyse it in terms of a set of such 'normal modes', but these have now to be regarded as being mutually dependent because of a certain kind of interaction. However, this kind of 'analysis and synthesis' is of only limited validity because in general the solutions of non-linear equations have properties that cannot be expressed in terms of such an analysis. (In mathematical terms, it can be said, for example, that

the analysis involves series that do not always converge.) Indeed, the non-linear equations of unified field theory are in general of this character. Thus, it is clear that not only is the notion of analysis in terms of spatially separate objects generally irrelevant in the context of such theories, but so also is the notion of analysis into more abstract constituents that are not regarded as separate in space.

It is important here to call attention to the difference between analysis and *description*. The word 'de-scribe' literally means to '*write* down', but when we write things down, this does not in general mean that the terms appearing in such a description can be actually 'loosened' or 'separated' into autonomously behaving components, and then put back together again in a synthesis. Rather, these terms are in general abstractions which have little or no meaning when considered as autonomous and separate from each other. Indeed, what is primarily relevant in a description is how the terms are *related* by ratio or reason. It is this ratio or reason, which calls attention to the whole, that is *meant* by a description.

Thus, even conceptually, a description does not in general constitute an analysis. Rather, a conceptual analysis provides a *special sort* of description, in which we can think about something as if it were broken into autonomously behaving parts, which are then thought about as put back together again in interaction. Such analytic forms of description were generally adequate for the physics of Galileo and Newton, but as has been indicated here, they have ceased to be so in the physics of Einstein.

Although Einstein made a very promising start along this new direction of thinking in physics, he was never able to arrive at a generally coherent and satisfactory theory, starting from the concept of a unified field. As pointed out earlier, physicists were therefore left with the problem of trying to adapt the older concept of analysis of the world into extensionless particles to

the context of relativity, in which such an analysis of the world is not really relevant or consistent.

It will be helpful here to consider certain possible inadequacies in Einstein's approach to these questions, though of course only in a very preliminary way. In this connection, it is useful to recall that in 1905 Einstein wrote three very fundamental papers, one on relativity, one on the quantum of light (photoelectric effects) and one on Brownian motion. A detailed study of these papers shows that they are intimately related in a number of ways, and this suggests that in Einstein's early thinking he was at least tacitly regarding these three subjects as aspects of one broader unity. However, with the development of general relativity there came a very heavy emphasis on the *continuity of fields*. The other two subjects (Brownian motion and the quantum properties of light) which involved some kind of discontinuity that was not in harmony with the notion of a continuous field, tended to fall into the background, and eventually, to be more or less dropped from consideration, at least within the context of general relativity.

In discussing this question, it will be helpful first to consider Brownian motion, which is indeed very difficult to describe in a relativistically invariant way. Because Brownian motion implies infinite 'instantaneous velocities', it cannot be restricted to the speed of light. However, in compensation, Brownian motion cannot in general be the carrier of a signal, for a signal is some *ordered* modulation of a 'carrier'. This order is not separable from the *meaning* of the signal (i.e., to change the order is to change the meaning). Thus, one can properly speak of propagation of a signal only in a context in which the movement of the 'carrier' is so regular and continuous that the order is not mixed up. With Brownian motion, however, the order is of such a high degree (i.e., 'random' in the usual sense of the word) that the meaning of a signal would no longer be left unaltered in its propagation. Therefore, there is no reason why a Brownian curve of infinite

order cannot be taken as part of a primary description of movement, as long as its *average* speed is not greater than that of light. In this way, it is possible for relativity theory to emerge as relevant to the *average speed* of a Brownian curve (which would also be appropriate for discussing the propagation of a signal), while it would have no relevance in a broader context in which the primary law would relate to Brownian curves of indefinitely high degree, rather than to a continuous curve of low degree. To develop such a theory would evidently imply a new order and measure in physics (going beyond both Newtonian and Einsteinian ideas), and it would lead to correspondingly new structures.

Consideration of such notions may perhaps point to something new and relevant. However, before this sort of inquiry is pursued further, it is better to go into the quantum theory, which is in many ways even more significant in this context than is Brownian motion.

7 QUANTUM THEORY

The quantum theory implies a much more radical change in notions of order and measure than even relativity did. To understand this change, one has to consider four new features of primary significance introduced by this theory.

7.1 Indivisibility of the quantum of action

This indivisibility implies that transitions between stationary states are in some sense discrete. Thus, it has no meaning to say that a system passes through a continuous series of intermediate states, similar to initial and final states. This is, of course, quite different from classical physics, which implies such a continuous series of intermediate states in every transition.

7.2 Wave-particle duality of the properties of matter

Under different experimental conditions, matter behaves more like a wave or more like a particle, but always, in certain ways, like both together.

7.3 Properties of matter as statistically revealed potentialities

Every physical situation is now characterized by a wave function (or more abstractly by a vector in Hilbert space). This wave function is not directly related to the *actual* properties of an individual object, event, or process. Rather, it has to be thought of as a description of the *potentialities* within the physical situation.[4] Different and generally mutually incompatible potentialities (e.g., for wavelike or particle-like behaviour) are actualized in different experimental arrangements (so that the wave-particle duality can be understood as one of the main forms for the expression of such incompatible potentialities). In general, the wave function gives only a *probability measure* for the actualization of different potentialities in a statistical ensemble of similar observations carried out under specified conditions, and cannot predict what will happen in detail in each individual observation.

This notion of statistical determination of mutually incompatible potentialities is evidently very different from what is done in classical physics, which has no place in it to give the notion of potentiality such a fundamental role. In classical physics, one thinks that only the *actual state* of a system can be relevant in a given physical situation, and that probability comes in either because we are ignorant of the actual state or because we are averaging over an ensemble of actual states that are distributed over a range of conditions. In quantum theory it has no meaning to discuss the actual state of a system apart from the whole set of experimental conditions which are essential to *actualize* this state.

7.4 Non-causal correlations (the paradox of Einstein, Podolsky and Rosen)

It is an inference from the quantum theory that events that are separated in space and that are without possibility of connection through interaction are correlated, in a way that can be shown to be incapable of a detailed causal explanation, through the propagation of effects at speeds not greater than that of light.[5] Thus, the quantum theory is not compatible with Einstein's basic approach to relativity, in which it is essential that such correlations be explainable by signals propagated at speeds not faster than that of light.

All of these evidently imply a breakdown of the general order of description that had prevailed before the advent of quantum theory. The limits of this 'pre-quantum' order are indeed brought out very clearly in terms of the uncertainty relations which are commonly illustrated in terms of Heisenberg's famous microscope experiment.

This experiment will now be discussed here, in a form somewhat different from that used by Heisenberg, in order to bring out certain new points. Our first step is to go into what it means to make a *classical* measurement of position and momentum. In doing this, we consider the use of an *electron* microscope, rather than a *light* microscope.

As shown in Figure 5.7, there is in the target an 'observed particle' at *O*, assumed to have initially a known momentum (e.g., it may be at rest, with zero momentum). Electrons of known energy are incident on the target, and one of these is deflected by the particle at *O*. It goes through the electron lens, following an orbit that leads it to the focus at *P*. From here, the electron leaves a track *T* in a certain direction, as it penetrates the photographic emulsion.

Now, the *directly observable results* of this experiment are the position *P* and the direction of the track *T*, but of course these are in

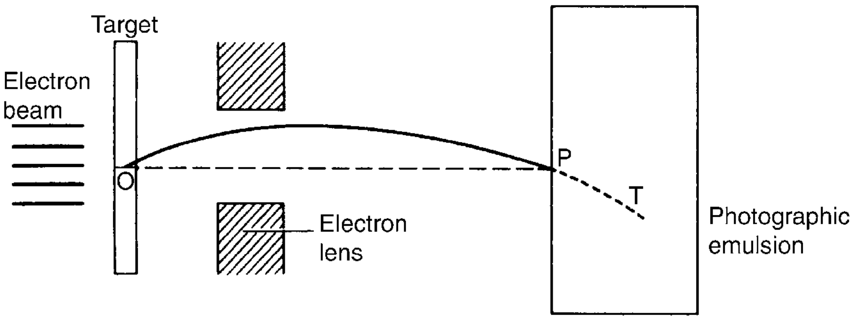

Figure 5.7

themselves of no interest. It is only by knowing overall the experimental conditions (i.e., the structure of the microscope, the target, the energy of the incident beam of electrons, etc.) that the experimental results become significant in the context of a physical inquiry. With the aid of an adequate description of these conditions, one can use the experimental results to make inferences about the position of the 'observed particle' at O, and about the momentum transferred to it in the process of deflecting the incident electron. Thus, although the operation of the instrument does influence the observed particle, this influence can be taken into account, so that we can infer, and thus 'know', both the position and the momentum of this particle at the time of deflection of the incident electron.

All this is quite straightforward in the context of classical physics. Heisenberg's novel step was to consider the implications of the 'quantum' character of the electron that provides the 'link' between the *experimental results* and *what is to be inferred from these results*. This electron can no longer be described as being just a classical particle. Rather, it has also to be described in terms of a 'wave', as shown in Figure 5.8. Electron waves are said to be incident on the target, and diffracted by the atom at O.

They then pass through the lens, where they are further diffracted and brought to focus in the emulsion at P. From here,

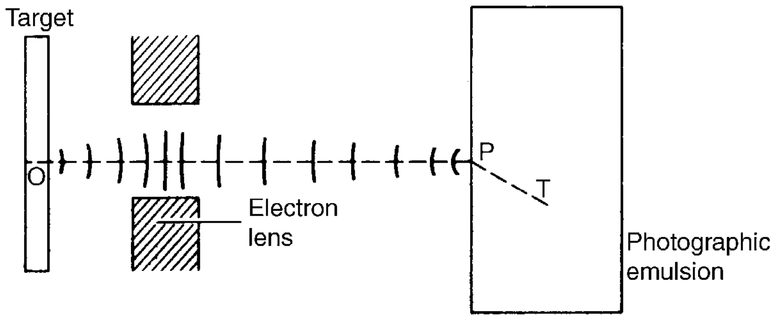

Figure 5.8

there starts a track *T* (just as happened in the classical description).

Evidently, Heisenberg has brought in the four primarily significant features of the quantum theory referred to at the beginning of this section. Thus (as happens in the interference experiment also), he describes the link electron *both* as a wave (while it is passing from object *O* through the lens to the image at *P*) *and* as a particle (when it arrives at the point *P* and then leaves a track *T*). The transfer of momentum to the 'observed atom' at *O* has to be treated as discrete and indivisible. Between *O* and *P* the most detailed possible description of the link electron is in terms of a wave function that determines only a statistical distribution of potentialities whose actualization depends on the experimental conditions (e.g., the presence of sensitive atoms in the emulsion, which can reveal the electron). Finally, the actual results (the spot *P*, the track *T*, and the properties of the atom *O*) are correlated in the non-causal way mentioned earlier in this chapter.

By using all these primary features of the quantum theory in discussing the 'link' electron, Heisenberg was able to show that there is a limit to the precision of inferences that can be drawn about the observed object, given by the uncertainty relations ($\Delta x \times \Delta p \geqslant h$). At first, Heisenberg explained the uncertainty as

the result of the 'uncertain' character of the precise orbit of the 'electron link' between O and P, which also implied an uncertain 'disturbance' of the atom O when this electron was scattered. However, Bohr[6] gave a relatively thorough and consistent discussion of the whole situation, which made it clear that the four primary aspects of the quantum theory as described above are not compatible with any description in terms of precisely defined orbits that are 'uncertain' to us. We have thus to do here with an entirely new situation in physics, in which the notion of a detailed orbit no longer has any meaning. Rather, one can perhaps say that the relationship between O and P through the 'link' electron is similar to an indivisible and unanalysable 'quantum jump' between stationary states, rather than to the continuous though not precisely known movement of a particle across the space between O and P.

What, then, can be the significance of the description that has been given of Heisenberg's experiment? Evidently, it is only in a context in which classical physics is applicable that this experiment can coherently be discussed in this way. Such a discussion can therefore at most serve to indicate the *limits of relevance* of classical modes of description; it cannot actually provide a description that is coherent in a 'quantum' context.

Even when regarded in this way, however, the usual discussion of the experiment overlooks certain key points which have deep and far-reaching significance. To see what these are, we note that from a particular set of experimental conditions as determined by the structure of the microscope, etc., one could in some rough sense say that the limits of applicability of the classical description are indicated by a certain cell in the phase space of this object, which we describe by *A* in Figure 5.9. If, however, there had been a different set of experimental conditions (e.g., a microscope of another aperture, electrons of different energy, etc.), then these limits would have had to be indicated by another cell in phase space, indicated by B. Heisenberg

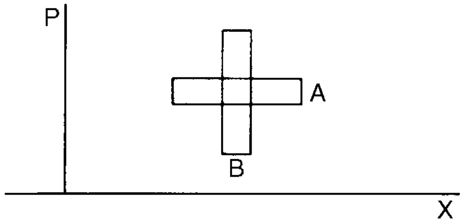

Figure 5.9

emphasized that both cells must have the same area, h, but in doing this he left out of account the significance of the fact that their 'shapes' are different.

Of course, in the context of classical physics (in which quantities of the order of Planck's constant, h, can be neglected), all cells can be replaced by dimensionless points, so that their 'shapes' have no significance at all. Therefore, the experimental results can be said to do nothing more than permit inferences to be drawn about an observed object, inferences in which the 'shapes' of the cells, and therefore the details of the experimental conditions, play only the role of intermediary links in the chain of reasoning, which drop out of the ultimate result that is inferred. This means that the observed object can consistently be said to exist separately and independently of the observing instrument, in the sense that it can be regarded as 'having' certain properties whether it interacts with anything else (such as an observing instrument) or not.

However, in the 'quantum' context the situation is very different. Here, the 'shapes' of the cells remain relevant, as essential parts of the description of the observed particle. This latter therefore cannot properly be described except in conjunction with a description of the experimental conditions; and if one goes in more detail into a mathematical treatment according to the laws of the quantum theory, the 'wave function' of the 'observed object' cannot be specified apart from a specification of the wave

function of the 'link electron', which in turn requires a description of the overall experimental conditions (so that the relationship between the object and the observed result is actually an example of the correlations of the type indicated by Einstein, Podolsky and Rosen, which cannot be explained in terms of the propagation of signals as chains of causal influence). This means that the description of the experimental conditions does not drop out as a mere intermediary link of inference, but remains inseparable from the description of what is called the observed object. The 'quantum' context thus calls for a new kind of description that does not imply the separability of the 'observed object' and 'observing instrument'. Instead, the form of the experimental conditions and the meaning of the experimental results have now to be one whole, in which analysis into autonomously existent elements is not relevant.

What is meant here by wholeness could be indicated metaphorically by calling attention to a pattern (e.g., in a carpet). In so far as what is relevant *is* the pattern, it has no meaning to say that different parts of such a pattern (e.g., various flowers and trees that are to be seen in the carpet) are separate objects in interaction. Similarly, in the quantum context, one can regard terms like 'observed object', 'observing instrument', 'link electron', 'experimental results', etc., as aspects of a single overall 'pattern' that are in effect abstracted or 'pointed out' by our mode of description. Thus, to speak of the interaction of 'observing instrument' and 'observed object' has no meaning.

A centrally relevant change in descriptive order required in the quantum theory is thus the dropping of the notion of analysis of the world into relatively autonomous parts, separately existent but in interaction. Rather, the primary emphasis is now on *undivided wholeness*, in which the observing instrument is not separable from what is observed.

Though quantum theory is very different from relativity, yet in some deep sense they have in common this implication of

undivided wholeness. Thus, in relativity, a consistent description of the instruments would have to be in terms of a structure of singularities in the field (corresponding to what are now generally called 'the constituent atoms' of the instrument). These would merge with the fields of the singularities constituting the 'observed particle' (and eventually with those constituting 'the atoms out of which the human observer is constituted'). This is a different sort of wholeness from that implied by the quantum theory, but it is similar in that there can be no ultimate division between the observing instrument and the observed object.

Nevertheless, in spite of this deep similarity, it has not proved possible to unite relativity and quantum theory in a coherent way. One of the main reasons is that there is no consistent means of introducing extended structure in relativity, so that particles have to be treated as extensionless points. This has led to infinite results in quantum field-theoretical calculations. By means of various formal algorithms (e.g., renormalization, *S* matrices, etc.) certain finite and essentially correct results have been abstracted from the theory. However, at bottom, the theory remains generally unsatisfactory, not only because it contains what at least appear to be some serious contradictions, but also because it certainly has a number of arbitrary features which are capable of indefinite adaptation to the facts, somewhat reminiscent of the way in which the Ptolemaic epicycles could be made to accommodate almost any observational data that might arise in the application of such a descriptive framework (e.g., in renormalization, the vacuum-state wave function has an infinite number of arbitrary features).

It would not, however, be very helpful here to make a detailed analysis of these problems. Rather, it will be more useful to call attention to a few general difficulties, the consideration of which will perhaps show that these details are not very relevant in the context of the present discussion.

First, quantum field theory begins by defining a field $\Psi(\mathbf{x}, t)$.

This field is a quantum operator, but **x** and *t* describe a continuous order in space and time. To bring the point out in more detail, we can write the matrix element Ψ_{ij} (**x**, t). However, as soon as we impose relativistic invariance, we deduce 'infinite fluctuations', i.e., Ψ_{ij} (**x**, t) is in general infinite and discontinuous because of 'zero-point' quantum fluctuations. This contradicts the original assumption of continuity of all functions required in any relativistic theory.

This emphasis on continuous orders is (as has been pointed out in the previous section) a serious weakness of the theory of relativity. If we deal with discontinuous order, however (e.g., as in Brownian motion), then the notion of signal ceases to be relevant (and with it, the notion of limitation to the speed of light); and without the notion of signal in a basic role, we are once again free to consider extended structures in a primary role in our descriptions.

Of course, the limitation to the speed of light will hold on the average and in the long run. Thus, relativistic notions will be relevant in suitable limiting cases. But the theory of relativity need not just be imposed on quantum theory. It is this imposition of the underlying *descriptive order* of one theory on another that led to arbitrary features and possible contradictions.

To see how this comes about we note that if the relativistic notion of giving a fundamental role to the possibility of *signalling* from one region *point* to another is to have any meaning, the *source* of a signal must be clearly separated from the region in which it is *received*, not only spatially but also in the sense that the two must be essentially autonomous in their behaviour.

Thus, as shown in Figure 5.10, if a signal is emitted from the world tube of a source of *A*, then it has to be propagated continuously without change of order to *B*, the world tube of the receiver. However, at a quantum level of description, the time order of events in the world tube at *A* and *B* may, according to the uncertainty principle, cease to be definable in the usual way.

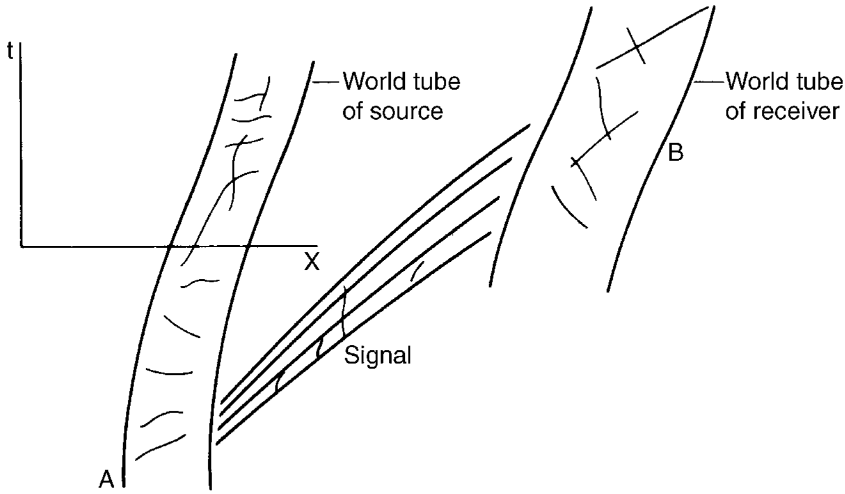

Figure 5.10

This alone would make the notion of a signal meaningless. In addition, the notion of a clear and distinct spatial separation of *A* and *B*, as well as that of possible autonomy in their behaviour, will cease to be relevant, because the 'contact' between *A* and *B* has now to be regarded as similar to an indivisible quantum jump of an atom between stationary states. Moreover, the further development of this notion along the lines of the experiment of Einstein, Podolsky and Rosen leads to the inference that the connection between *A* and *B* cannot in general be described in terms of the propagation of causal influences (which type of propagation is evidently necessary to provide for an underlying 'carrier' of the signal).

It seems clear, then, that the relativistic notion of a signal simply does not fit coherently into the 'quantum' context. This is basically because such a signal implies the possibility of a *certain kind of analysis* which is not compatible with the sort of undivided wholeness that is implied by the quantum theory. In this connection, it may indeed be said that although Einstein's unified field theory denies the possibility of ultimate analysis of the

world into autonomous component elements, nevertheless, the notion that the possibility of a signal plays such a basic role implies a different and more abstract sort of analysis based on a kind of independent and autonomous 'information content' which is different in different regions. This abstract kind of analysis may not only be inconsistent with quantum theory but, very probably, also with the undivided wholeness implied in the other aspects of the theory of relativity.

What suggests itself, then, is that we seriously consider the possibility of dropping the idea of the basic role of the notion of signal, but go on with the other aspects of relativity theory (especially the principle that laws are invariant relationships, and that through non-linearity of the equations, or in some other way, analysis into autonomous components will cease to be relevant). Thus, by letting go of this kind of attachment to a certain kind of analysis that does not harmonize with the 'quantum' context, we open the way for a new theory that comprehends what is still valid in relativity theory, but does not deny the indivisible wholeness implied by the quantum theory.

On the other hand, quantum theory also contains an implicit attachment to a certain very abstract kind of analysis which does not harmonize with the sort of indivisible wholeness implied by the theory of relativity. To see what this is, we note that discussions such as those centring around the Heisenberg microscope emphasize the indivisible wholeness of the observing instrument and the observed object only in context of the *actual* results of an experiment. However, in the mathematical theory, the wave function is still generally taken to be a description of overall *statistical potentialities* that are regarded as existing separately and autonomously. In other words, the *actual and individual object* of classical physics is replaced by a more abstract kind of *potential and statistical object*. This latter is said to correspond to the 'quantum state of the system', which in turn corresponds to 'the wave function of the system' (or more generally to a vector in Hilbert

space). Such usage of language (e.g., to bring in words such as 'state of a system') implies that we are thinking of something that has a separate and autonomous kind of existence.

The consistency of this way of using language depends to a large extent on the mathematical assumption that the wave equation (i.e., the law governing the changes with time of the wave function, or the Hilbert space vector) is linear. (Non-linear equations for field operations have been proposed but, even here, this is only a limited kind of non-linearity, in the sense that the basic equation for 'the state vector in Hilbert space' is always taken to be linear.) Such linearity of equations then allows us to regard 'state vectors' as having a kind of autonomous existence (similar in certain ways to that which is attributed in classical field theories to normal modes, but different in that they are more abstract).

This complete autonomy of the 'quantum state' of a system is supposed to hold only when it is not being observed. In an observation, it is assumed that we have to do with two initially autonomous systems that have come into interaction.[7] One of these is described by the 'state vector of the observed object' and the other by the 'state vector of the observing apparatus'.

In the consideration of this interaction, certain new features are introduced which correspond to allowing for the possibility of actualizing the observed system's potentialities at the expense of others that cannot be actualized at the same time. (Mathematically, one can say that 'the wave packet is reduced' or that 'a projection operation takes place'.)

There is a great deal of controversy and discussion as to precisely how this stage is to be treated, because the basic notions involved do not seem to be very clear. However, it is not our aim here to criticize these efforts in detail. Rather, we wish merely to point out that this whole line of approach re-establishes at the abstract level of statistical potentialities the same kind of analysis into separate and autonomous components in interaction that is

denied at the more concrete level of individual objects. It is just this kind of abstract analysis that does not cohere with the underlying basic descriptive order of relativity theory, for, as has been seen, relativity theory is not compatible with such an analysis of the world into separate components. Rather, it ultimately implies that such 'objects' have to be understood as merging with each other (as field singularities do) to make one indivisible whole. Similarly, one may consider the notion that through a thoroughgoing non-linearity, or in some other way, quantum theory may be allowed to change, so that the resulting new theory will also imply undivided wholeness, not merely at the level of actual individual phenomena, but also at the level of potentialities treated in terms of statistical aggregates. In this way, those aspects of quantum theory that are still valid will be able to harmonize with those aspects of relativity that are still valid.

To give up both the basic role of signal and that of quantum state is, however, no small thing. To find a new theory that goes on without these will evidently require radically new notions of order, measure and structure.

One may suggest here that we are in a position which is in certain ways similar to where Galileo stood when he began his inquiries. A great deal of work has been done showing the inadequacy of old ideas, which merely permit a range of new facts to be *fitted mathematically* (comparable to what was done by Copernicus, Kepler and others), but we have not yet freed ourselves thoroughly from the old order of thinking, using language, and observing. We have thus yet to perceive a new *order*. As with Galileo, this must involve seeing new differences so that much of what has been thought to be basic in the old ideas will be perceived to be more or less correct, but not of primary relevance (as happened, for example, with some of the key ideas of Aristotle). When we see the new basic differences, then (as happened with Newton) we will be able to perceive a new universal ratio or reason relating and unifying all the differences.

This may ultimately carry us as far beyond quantum theory and relativity as Newton's ideas went beyond those of Copernicus.

Of course, this cannot be done overnight. We have to work patiently, slowly, and carefully, to understand the present general situation in physics in a new way. Some preliminary steps of this kind will be discussed in chapter 6.

6

QUANTUM THEORY AS AN INDICATION OF A NEW ORDER IN PHYSICS

Part B: Implicate and Explicate Order in Physical Law

1 INTRODUCTION

Chapter 5 called attention to the emergence of new orders throughout the history of physics. A general feature of the development of this subject has been a tendency to regard certain basic notions of order as permanent and unchangeable. The task of physics was then taken to be to *accommodate* new observations by means of *adaptations* within these basic notions of order, so as to fit the new facts. This kind of adaptation began with the Ptolemaic epicycles, which continued from ancient times until the advent of the work of Copernicus, Kepler, Galileo, and Newton. As soon as the basic notions of

order in classical physics had been fairly clearly expressed, it was supposed that further work in physics would consist of adaptation within this order to accommodate new facts. This continued until the appearance of relativity and the quantum theory. It can accurately be said that since then the main line of work in physics has been adaptation within the general orders underlying these theories, to accommodate the facts to which these in turn have led.

It may thus be inferred that accommodation within already existing frameworks of order has generally been considered to be the main activity to be emphasized in physics, while the perception of new orders has been thought of as something that happens only occasionally, perhaps in revolutionary periods, during which what is regarded as the normal process of accommodation has broken down.[1]

It is pertinent to this subject to consider Piaget's[2] description of all intelligent perception in terms of two complementary movements, *accommodation* and *assimilation*. From the roots 'mod', meaning 'measure', and 'com', meaning 'together', one sees that to accommodate means 'to establish a common measure' (see chapter 5 for a discussion of the broader sense of the notions of measure that are relevant in this context). Examples of accommodation are fitting, cutting to a pattern, adapting, imitating, conforming to rules, etc. On the other hand, 'to assimilate' is 'to digest' or to make into a comprehensive and inseparable whole (which includes oneself). Thus, to assimilate means 'to understand'.

It is clear that in intelligent perception, primary emphasis has in general to be given to assimilation, while accommodation tends to play a relatively secondary role in the sense that its main significance is as an aid to assimilation.

Of course, we are able in certain sorts of contexts just to accommodate something that we observe within known orders of thought, and in this very act it will be adequately assimilated.

However, it is necessary in more general contexts to give serious attention to the possibility that the old orders of thought may cease to be relevant, so that they can no longer coherently be adapted to fit the new fact. As has been brought out in some detail in chapter 5 one may then have to see the irrelevance of old differences, and the relevance of new differences, and thus one may open the way to the perception of new orders, new measures and new structures.

Clearly, such perception can appropriately take place at almost any time, and does not have to be restricted to unusual and revolutionary periods in which one finds that the older orders can no longer be conveniently adapted to the facts. Rather, one may be continually ready to drop old notions of order at various contexts, which may be broad or narrow, and to perceive new notions that may be relevant in such contexts. Thus, understanding the fact by assimilating it into new orders can become what could perhaps be called the normal way of doing scientific research.

To work in this way is evidently to give primary emphasis to something similar to *artistic perception*. Such perception begins by observing the whole fact in its full individuality, and then by degree articulates the order that is proper to the assimilation of this fact. It does not begin with abstract preconceptions as to what the order has to be, which are then adapted to the order that is observed.

What, then, is the proper role of accommodation of facts within known theoretical orders, measures and structures? Here, it is important to note that facts are not to be considered as if they were independently existent objects that we might find or pick up in the laboratory. Rather, as the Latin root of the word 'facere' indicates, the fact is 'what has been made' (e.g., as in 'manufacture'). Thus, in a certain sense, we 'make' the fact. That is to say, beginning with immediate perception of an actual situation, we develop the fact by giving it further order, form

and structure with the aid of our theoretical concepts. For example, by using the notions of order prevailing in ancient times, men were led to 'make' the fact about planetary motions by describing and measuring in terms of epicycles. In classical physics, the fact was 'made' in terms of the order of planetary orbits, measured through positions and times. In general relativity, the fact was 'made' in terms of the order of Riemannian geometry, and of the measure implied by concepts such as 'curvature of space'. In the quantum theory, the fact was made in terms of the order of energy levels, quantum numbers, symmetry groups, etc., along with appropriate measures (e.g. scattering cross-sections, charges, and masses of particles, etc.).

It is clear, then, that changes of order and measures in the theory ultimately lead to new ways of doing experiments and to new kinds of instruments, which in turn lead to the 'making' of correspondingly ordered and measured facts of new kinds. In this development, the experimental fact serves in the first instance as a test for theoretical notions. Thus, as has been pointed out in chapter 5, the general form of theoretical explanation is that of a generalized kind of ratio of reason. 'As *A* is to *B* in our structure of thinking, so it is in fact.' This ratio or reason constitutes a kind of 'common measure' or 'accommodation' between theory and fact.

As long as such a common measure prevails, then of course the theory used need not be changed. If the common measure is found not to be realized, then the first step is to see whether it can be re-established by means of adjustments within the theory without a change in its underlying order. If, after reasonable efforts, a proper accommodation of this kind is not achieved, then what is needed is a fresh perception of *the whole fact*. This now includes not only the results of experiments but also the *failure of certain lines of theory to fit the experimental results in a 'common measure'*. Then, as has been indicated earlier, one has to be very sensitively aware of all the relevant differences which underly

the main orders in the old theory, to see whether there is room for a change of overall order. It is being emphasized here that this kind of perception should properly be interwoven continually with the activities aimed at accommodation, and should not have to be delayed for so long that the whole situation becomes confused and chaotic, apparently requiring the revolutionary destruction of the old order to clear it up.

As relativity and quantum theory have shown that it has no meaning to divide the observing apparatus from what is observed, so the considerations discussed here indicate that it has no meaning to separate the observed fact (along with the instruments used to observe it) from the theoretical notions of order that help to give 'shape' to this fact. As we go on to develop new notions of order going beyond those of relativity and quantum theory, it will thus not be appropriate to try immediately to apply these notions to current problems that have arisen in the consideration of the present set of experimental facts. Rather, what is called for in this context is very broadly to assimilate the whole of the fact in physics into the new theoretical notions of order. After this fact has geneally been 'digested', we can begin to glimpse new ways in which such notions of order can be tested and perhaps extended in various directions. As pointed out at the end of chapter 5, we have to proceed slowly and patiently here or else we may become confused by 'undigested' facts.

Fact and theory are thus seen to be different aspects of one whole in which analysis into separate but interacting parts is not relevant. That is to say, not only is undivided wholeness implied in the *content* of physics (notably relativity and quantum theory) but also in the *manner of working* in physics. This means that we do not try *always* to force the theory to fit the kinds of facts that may be appropriate in currently accepted general orders of description, but that we are also ready when necessary to consider changes in what is meant by fact, which may be required

for assimilation of such fact into new theoretical notions of order.

2 UNDIVIDED WHOLENESS – THE LENS AND THE HOLOGRAM

The undivided wholeness of modes of observation, instrumentation and theoretical understanding indicated above implies the need to consider a *new order of fact*, i.e., the fact about the way in which modes of theoretical understanding and of observation and instrumentation are related to each other. Until now, we have more or less just taken such a relationship for granted, without giving serious attention to the manner in which it arises, very probably because of the belief that the study of the subject belongs to 'the history of science' rather than to 'science proper'. However, it is now being suggested that the consideration of this relationship is essential for an adequate understanding of science itself, because the content of the observed fact cannot coherently be regarded as separate from modes of observation and instrumentation and modes of theoretical understanding.

An example of the very close relationship between instrumentation and theory can be seen by considering the *lens*, which was indeed one of the key features behind the development of modern scientific thought. The essential feature of a lens is, as indicated in Figure 6.1, that it forms an *image* in which a given point *P* in the object corresponds (in a high degree of approximation) to a point *Q* in the image. By thus bringing the correspondence of specified features of object and image into such sharp relief, the lens greatly strengthened man's awareness of the various parts of the object and of the relationship between these parts. In this way, it furthered the tendency to think in terms of analysis and synthesis. Moreover, it made possible an enormous extension of the classical order of analysis and synthesis to

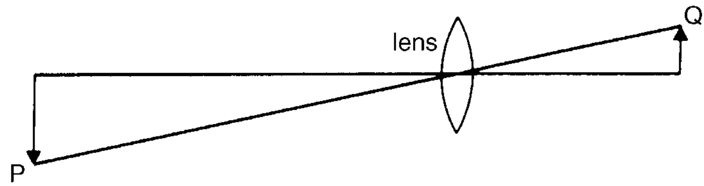

Figure 6.1

objects that were too far away, too big, too small, or too rapidly moving to be thus ordered by means of unaided vision. As a result, scientists were encouraged to extrapolate their ideas and to think that such an approach would be relevant and valid no matter how far they went, in all possible conditions, contexts, and degrees of approximation.

However, as has been seen in chapter 5 relativity and quantum theory imply undivided wholeness, in which analysis into distinct and well-defined parts is no longer relevant. Is there an instrument that can help give a certain immediate perceptual insight into what can be meant by undivided wholeness, as the lens did for what can be meant by analysis of a system into parts? It is suggested here that one can obtain such insight by considering *hologram*. (The name is derived from the Greek words 'holo', meaning 'whole', and 'gram', meaning 'to write'. Thus, the hologram is an instrument that, as it were, 'writes the whole'.)

As shown in Figure 6.2 coherent light from a laser is passed through a half-silvered mirror. Part of the beam goes on directly to a photographic plate, while another part is reflected so that it illuminates a certain whole structure. The light reflected from this whole structure also reaches the plate, where it interferes with that arriving there by a direct path. The resulting interference pattern which is recorded on the plate is not only very complex but also usually so fine that it is not even visible to the naked eye. Yet, it is somehow relevant to the whole illuminated structure, though only in a highly implicit way.

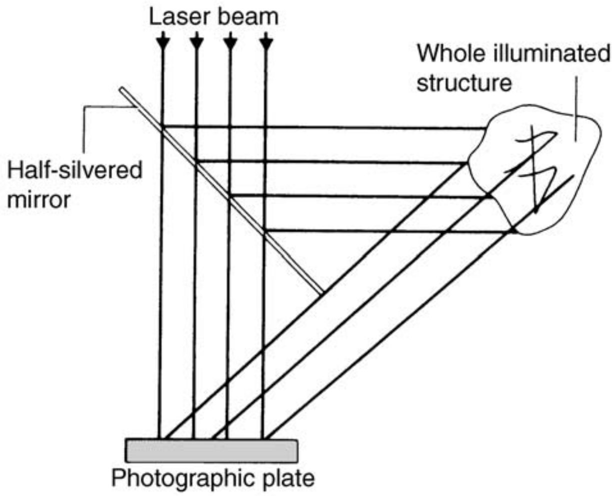

Figure 6.2

This relevance of the interference pattern to the whole illuminated structure is revealed when the photographic plate is illuminated with laser light. As shown in Figure 6.3, a wavefront is then created which is very similar in form to that coming off the original illuminated structure. By placing the eye in this way, one in effect sees the whole of the original structure, in three dimensions, and from a range of possible points of view (as if one were looking at it through a window). If we then illuminate only a small region *R* of the plate, we *still see the whole structure*, but in somewhat less sharply defined detail and from a decreased range of possible points of view (as if we were looking through a smaller window).

It is clear, then, that there is no one-to-one correspondence between parts of an 'illuminated object' and parts of an 'image of this object on the plate'. Rather, the interference pattern in each region *R* of the plate is relevant to the whole structure, and each region of the structure is relevant to the whole of the interference pattern on the plate.

Because of the wave properties of light, even a lens cannot

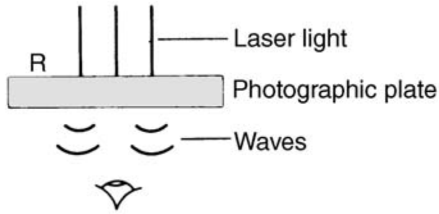

Figure 6.3

produce an exact one-to-one correspondence. A lens can therefore be regarded as a limiting case of a hologram.

We can, however, go further and say that in their overall ways of indicating the meaning of observations, typical experiments as currently done in physics (especially in the 'quantum' context) are more like the general case of a hologram than like the special case of a lens. For example, consider a scattering experiment. As shown in Figure 6.4 what can be observed in the detector is generally relevant to the whole target, or at least to an area large enough to contain a great many atoms.

Moreover, although one might in principle try to make an image of a particular atom, the quantum theory implies that to do this would have little or no significance. Indeed, as the discussion of the Heisenberg microscope experiment given in chapter 5 shows, the formation of an image is just what is *not* relevant in a 'quantum' context; at most a discussion of image formation serves to indicate the limits of applicability of classical modes of description.

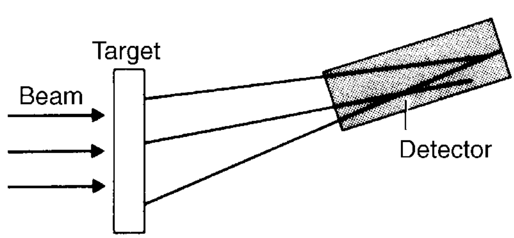

Figure 6.4

So we may say that in current research in physics, an instrument tends to be relevant to a whole structure, in a way rather similar to what happens with a hologram. To be sure, there are certain differences. For example, in current experiments with electron beams or with X-rays, these latter are seldom coherent over appreciable distances. If, however, it should ever prove to be possible to develop something like an electron laser or an X-ray laser, then experiments will directly reveal 'atomic' and 'nuclear' structures without the need for complex chains of inference of the sort now generally required, as the hologram does for ordinary large-scale structures.

3 IMPLICATE AND EXPLICATE ORDER

What is being suggested here is that the consideration of the difference between lens and hologram can play a significant part in the perception of a new order that is relevant for physical law. As Galileo noted the distinction between a viscous medium and a vacuum and saw that physical law should refer primarily to the order of motion of an object in a vacuum, so we might now note the distinction between a lens and a hologram and consider the possibility that physical law should refer primarily to an order of undivided wholeness of the content of a description similar to that indicated by the hologram rather than to an order of analysis of such content into separate parts indicated by a lens.

However, when Aristotle's ideas on movement were dropped, Galileo and those who followed him had to consider the question of how the new order of motion was to be described in adequate details. The answer came in the form of Cartesian coordinates extended to the language of the calculus (differential equations, etc.). But this kind of description is of course appropriate only in a context in which analysis into distinct and autonomous parts is relevant, and will therefore in turn have to

be dropped. What, then, will be the new kind of description appropriate to the present context?

As happened with Cartesian coordinates and the calculus, such a question cannot be answered immediately in terms of definite prescriptions as to what to do. Rather, one has to observe the new situation very broadly and tentatively and to 'feel out' what may be the relevant new features. From this, there will arise a discernment of the new order, which will articulate and unfold in a natural way (and not as a result of efforts to make it fit well-defined and preconceived notions as to what this order should be able to achieve).

We can begin such an inquiry by noting that in some subtle sense, which does not appear in ordinary vision, the interference pattern in the whole plate can distinguish different orders and measures in the whole illuminated structure. For example, the illuminated structure may contain all sorts of shapes and sizes of geometric forms (indicated in Figure 6.5a), as well as topological relationships, such as inside and outside (indicated in Figure 6.5b), and intersection and separation (indicated in Figure 6.5c). All of these lead to different interference patterns and it is this difference that is somehow to be described in detail.

The differences indicated above are, however, not only in the plate. Indeed, the latter is of secondary significance, in the sense that its main function is to make a relatively permanent 'written record' of the interference pattern of the light that is present in

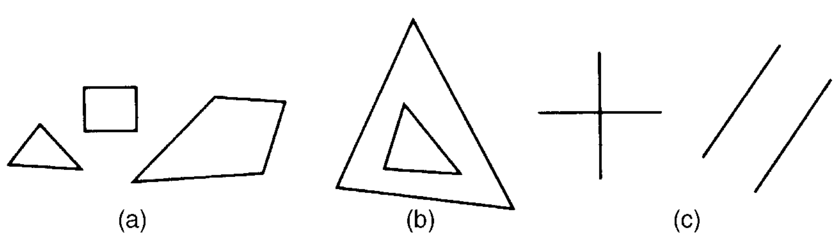

Figure 6.5

each region of space. More generally, however, in each such region, the movement of the light implicitly contains a vast range of distinctions of order and measure, appropriate to a whole illuminated structure. Indeed, in principle, this structure extends over the whole universe and over the whole past, with implications for the whole future. Consider, for example, how on looking at the night sky, we are able to discern structures covering immense stretches of space and time, which are in some sense contained in the movements of light in the tiny space encompassed by the eye (and also how instruments, such as optical and radio telescopes, can discern more and more of this totality, contained in each region of space).

There is the germ of a new notion of order here. This order is not to be understood solely in terms of a regular arrangement of *objects* (e.g., in rows) or as a regular arrangement of *events* (e.g. in a series). Rather, a *total order* is contained, in some *implicit* sense, in each region of space and time.

Now, the word 'implicit' is based on the verb 'to implicate'. This means 'to fold inward' (as multiplication means 'folding many times'). So we may be led to explore the notion that in some sense each region contains a total structure 'enfolded' within it.

It will be useful in such an exploration to consider some further examples of enfolded or *implicate* order. Thus, in a television broadcast, the visual image is translated into a time order, which is 'carried' by the radio wave. Points that are near each other in the visual image are not necessarily 'near' in the order of the radio signal. Thus, the radio wave carries the visual image in an implicate order. The function of the receiver is then to *explicate* this order, i.e., to 'unfold' it in the form of a new visual image.

A more striking example of implicate order can be demonstrated in the laboratory, with a transparent container full of a very viscous fluid, such as treacle, and equipped with a

mechanical rotator that can 'stir' the fluid very slowly but very thoroughly. If an insoluble droplet of ink is placed in the fluid and the stirring device is set in motion, the ink drop is gradually transformed into a thread that extends over the whole fluid. The latter now appears to be distributed more or less at 'random' so that it is seen as some shade of grey. But if the mechanical stirring device is now turned in the opposite direction, the transformation is reversed, and the droplet of dye suddenly appears, reconstituted. (This illustration of the implicate order is discussed further in chapter 7.)

When the dye was distributed in what appeared to be a random way, it nevertheless had *some kind* of order which is different, for example, from that arising from another droplet originally placed in a different position. But this order is *enfolded* or *implicated* in the 'grey mass' that is visible in the fluid. Indeed, one could thus 'enfold' a whole picture. Different pictures would look indistinguishable and yet have different implicate orders, which differences would be revealed when they were explicated, as the stirring device was turned in a reverse direction.

What happens here is evidently similar in certain crucial ways to what happens with the hologram. To be sure there are differences. Thus, in a fine enough analysis, one could see that the *parts* of the ink droplet remain in a one-to-one correspondence as they are stirred up and the fluid moves continuously. On the other hand, in the functioning of the hologram there is no such one-to-one correspondence. So in the hologram (as also in experiments in a 'quantum' context), there is no way ultimately to reduce the implicate order to a finer and more complex type of explicate order.

All this calls attention to the relevance of a new distinction between implicate and explicate order. Generally speaking, the laws of physics have thus far referred mainly to the explicate order. Indeed, it may be said that the principle function of Cartesian coordinates is just to give a clear and precise description

of explicate order. Now, we are proposing that in the formulation of the laws of physics, primary relevance is to be given to the implicate order, while the explicate order is to have a secondary kind of significance (e.g., as happened with Aristotle's notion of movement, after the development of classical physics). Thus, it may be expected that a description in terms of Cartesian coordinates can no longer be given a primary emphasis, and that a new kind of description will indeed have to be developed for discussing the laws of physics.

4 THE HOLOMOVEMENT AND ITS ASPECTS

To indicate a new kind of description appropriate for giving primary relevance to implicate order, let us consider once again the key feature of the functioning of the hologram, i.e., in each region of space, the order of a whole illuminated structure is 'enfolded' and 'carried' in the movement of light. Something similar happens with a signal that modulates a radio wave (see Figure 6.6). In all cases, the content or meaning that is 'enfolded' and 'carried' is primarily an order and a measure, permitting the development of a structure. With the radio wave, this structure can be that of a verbal communication, a visual image, etc., but with the hologram far more subtle structures can be involved in this way (notably three-dimensional structures, visible from many points of view).

More generally, such order and measure can be 'enfolded' and 'carried' not only in electromagnetic waves but also in other ways (by electron beams, sound, and in other countless forms of

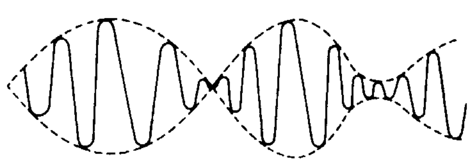

Figure 6.6

movement). To generalize so as to emphasize undivided wholeness, we shall say that what 'carries' an implicate order is *the holomovement*, which is an unbroken and undivided totality. In certain cases, we can abstract particular aspects of the holomovement (e.g., light, electrons, sound, etc.), but more generally, all forms of the holomovement merge and are inseparable. Thus, in its totality, the holomovement is not limited in any specifiable way at all. It is not required to conform to any particular order, or to be bounded by any particular measure. Thus, *the holomovement is undefinable and immeasurable*.

To give primary significance to the undefinable and immeasurable holomovement implies that it has no meaning to talk of a *fundamental* theory, on which *all* of physics could find a *permanent* basis, or to which *all* the phenomena of physics could ultimately be reduced. Rather, each theory will abstract a certain aspect that is *relevant* only in some limited context, which is indicated by some appropriate measure.

In discussing how attention is to be called to such aspects, it is useful to recall that the word 'relevant' is a form obtained from the verb 'to relevate' which has dropped out of common usage, and which means 'to lift up' (as in 'elevate'). We can thus say in a particular context that may be under consideration, the general modes of description that belong to a given theory serve to *relevate* a certain content, i.e., to lift it into attention so that it stands out 'in relief'. If this content is pertinent in the context under discussion, it is said to be *relevant*, and otherwise, *irrelevant*.

To illustrate what it means to relevate certain aspects of the implicate order in the holomovement, it is useful to consider once again the example of the mechanical device for stirring a viscous fluid, as described in the previous section. Suppose that we first put in a droplet of dye and turn the stirring mechanism *n* times. We could then place another droplet of dye nearby and stir once again through *n* turns. We could repeat this process

Figure 6.7

indefinitely, with a long series of droplets, arranged more or less along a line, as shown in Figure 6.7.

Suppose, then, that after thus 'enfolding' a large number of droplets, we turn the stirring device in a reverse direction, but so rapidly that the individual droplets are not resolved in perception. Then we will see what appears to be a 'solid' object (e.g. a particle) moving continuously through space. This form of a moving object appears in immediate perception primarily because the eye is not sensitive to concentrations of dye lower than a certain minimum, so that one does not directly see the 'whole movement' of the dye. Rather, such perception *relevates a certain aspect*. That is to say, it makes this aspect stand out 'in relief' while the rest of the fluid is seen only as a 'grey background' within which the related 'object' seems to be moving.

Of course, such an aspect has little interest *in itself*, i.e. apart from its *broader meaning*. Thus, in the present example, one possible meaning is that there *actually is* an autonomous object moving through the fluid. This would signify, of course, that the whole order of movement is to be regarded as similar to that in the immediately perceived aspect. In some contexts, such a meaning is pertinent and adequate (e.g., if we are dealing in the ordinary level of experience with a rock flying through the air). However, in the present context, a very different meaning is indicated, and this can be communicated only through a very different kind of description.

Such a description has to start by *conceptually* relevating certain broader orders of movement, going beyond any that are similar to those relevated in immediate perception. In doing this, one always begins with the holomovement, and then one abstracts special aspects which involve a totality broad enough for a

proper description in the context under discussion. In the present example, this totality should include the whole movement of the fluid and the dye as determined by the mechanical stirring device, and the movement of the light, which enables us visually to perceive what is happening, along with the movement of the eye and nervous system, which determines the distinctions that can be perceived in the movement of light.

It may then be said that the content relevated in immediate perception (i.e., the 'moving object') is a kind of *intersection* between two orders. One of these is the order of movement that brings about the possibility of a direct perceptual contact (in this case, that of the light and the response of the nervous system to this light), and the other is an order of movement that determines the detailed content that is perceived (in this case, the order of movement of the dye in the fluid). Such a description in terms of intersection of orders is evidently very generally applicable.[3]

It has already been seen that, in general, the movement of *light* is to be described in terms of 'the enfolding and carrying' of implicate orders that are relevant to a whole structure, in which analysis into separate and autonomous parts is not applicable (though, of course, in certain limited contexts, a description in terms of explicate orders will be adequate). In the present example, however, it is also appropriate to describe the movement of *the dye* in similar terms. That is to say, in the movement, certain implicate orders (in the distribution of dye) become explicate, while explicate orders become implicate.

To specify this movement in more detail, it is useful here to introduce a new *measure*, i.e., an 'implication parameter', denoted by T. In the fluid, this would be the number of turns needed to bring a given droplet of dye into explicate form. The total structure of dye present at any moment can then be regarded as an ordered series of substructures, each corresponding to a single droplet N with its implication parameter T_N.

Evidently, we have here a new notion of structure, for we no longer build structures solely as ordered and measured arrangements on which we join separate things, all of which are explicate together. Rather, we can now consider structures in which aspects of different degrees of implication (as measured by T) can be arranged in a certain order.

Such aspects can be quite complex. For example, we could implicate a 'whole picture' by turning the stirring device n times. We could then implicate a slightly different picture, and so on indefinitely. If the stirring device were turned rapidly in the reverse direction, we could see a 'three-dimensional scene' apparently consisting of a 'whole system' of objects in continuous movement and interaction.

In this movement, the 'picture' present at any given moment would consist only of aspects that can be explicated together (i.e., aspects corresponding to a certain value of the implication parameter T). As events happening at the same time are said to be *synchronous*, so aspects that can be explicated together can be called *synordinate*, while those that cannot be explicated together may then be called *asynordinate*. Evidently, the new notions of structure under discussion here involve *asynordinate* aspects, whereas previous notions involve only *synordinate* aspects.

It has to be emphasized here that the order of implication, as measured by the parameter T, has no necessary relationship to the order of time (as measured by *another* parameter, t). These two parameters are only related in a *contingent* manner (in this case by the rate of turning of the stirring device). It is the T parameter that is directly relevant to the description of the implicate structure, and not the t parameter.

When a structure is *asynordinate* (that is, constituted of aspects with different degrees of implication), then evidently the time order is not in general the primary one that is pertinent for the expression of law. Rather, as one can see by considering the previous examples, the *whole implicate order* is present at any

moment, in such a way that the entire structure growing out of this implicate order can be described without giving any primary role to time. The law of the structure will then just be a law relating aspects with various degrees of implication. Such a law will, of course, not be deterministic *in time*. But, as has been indicated in chapter 5 determinism in time is not the only form of ratio or reason; and as long as we can find ratio or reason in the orders that are primarily relevant, this is all that is needed for law.

One can see in the 'quantum context' a significant similarity to the orders of movement that have been described in terms of the simple examples discussed above. Thus, as shown in Figure 6.8 'elementary particles' are generally observed by means of tracks that they are supposed to make in detecting devices (photographic emulsions, bubble chambers, etc). Such a track is evidently to be regarded as no more than an *aspect* appearing in immediate perception (as was done with the moving sequence of droplets of dye indicated in Figure 6.7). To describe it as the track of a 'particle' is then to assume in addition that the primarily relevant order of movement is similar to that in the immediately perceived aspect.

However, the whole discussion of the new order implicit in the quantum theory shows that such a description cannot coherently be maintained. For example, the need to describe movement discontinuously in terms of 'quantum jumps' implies that the notion of a well-defined orbit of a particle that connects the

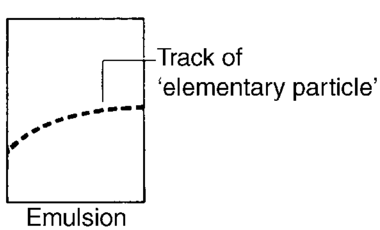

Figure 6.8

visible marks constituting the track cannot have any meaning. In any case, the wave-particle properties of matter show that the overall movement depends on the total experimental arrangement in a way that is not consistent with the idea of autonomous motion of localized particles; and, of course, the discussion of the Heisenberg microscope experiment indicates the relevance of a new order of undivided wholeness in which it has no meaning to talk about an observed object as if it were separate from the entire experimental situation in which observation takes place. So the use of the descriptive term 'particle' in this 'quantum' context is very misleading.

Evidently, we have here to deal with something that is similar in certain important ways to the example of stirring a dye into a viscous fluid. In both cases, there appears in immediate perception an explicate order that cannot consistently be regarded as autonomous. In the example of the dye, the explicate order is determined as an intersection of the implicate order of 'the whole movement' of the fluid and an implicate order of distinctions of density of dye that are relevated in sense perception. In the 'quantum' context, there similarly will be an intersection of an implicate order of some 'whole movement' corresponding to what we have called, for example, 'the electron', and another implicate order of distinctions that are relevated (and recorded) by our instruments. Thus, the word 'electron' should be regarded as no more than a name by which we call attention to a certain aspect of the holomovement, an aspect that can be discussed only by taking into account the entire experimental situation and that cannot be specified in terms of localized objects moving autonomously through space. And, of course, every kind of 'particle' which in current physics is said to be a basic constituent of matter will have to be discussed in the same sort of terms (so that such 'particles' are no longer considered as autonomous and separately existent). Thus, we come to a new general physical

description in which 'everything implicates everything' in an order of undivided wholeness.

A mathematical discussion of how the 'quantum' context can be assimilated in terms of the sort of implicate order discussed above is given in the appendix to this chapter.

5 LAW IN THE HOLOMOVEMENT

We have seen that in the 'quantum' context, the order in every immediately perceptible aspect of the world is to be regarded as coming out of a more comprehensive implicate order, in which all aspects ultimately merge in the undefinable and immeasurable holomovement. How, then, are we to understand the fact that descriptions involving the analysis of the world into autonomous components do actually work, at least in certain contexts (e.g., those in which classical physics is valid)?

To answer the question, we first note that the word 'autonomy' is based on two Greek words: 'auto', meaning 'self', and 'nomos' meaning 'law'. So, to be autonomous is to be *self-ruling*.

Evidently, nothing is 'a law unto itself'. At most, something may behave with a *relative and limited degree* of autonomy, under certain conditions and in certain degrees of approximation. Indeed, at the very least, each relatively autonomous thing (e.g., a particle) is limited by other such relatively autonomous things. Such a limitation is currently described in terms of *interaction*. However, we shall introduce here the word 'heteronomy' to call attention to a law in which many relatively autonomous things are related in this way, i.e., externally and more or less mechanically.

Now, what is characteristic of heteronomy is the applicability of *analytic descriptions*. (As pointed out in chapter 5, the root of the word 'analysis' is the Greek 'lysis' meaning 'to dissolve' or 'to loosen'. Since the prefix 'ana' means 'above', it may be said that 'to analyse' is to 'loosen from above', i.e., to obtain a broad view

as if from a great height in terms of components that are regarded as autonomous and separately evident though in mutual interaction.)

As has been seen, however, in sufficiently broad contexts such analytic descriptions cease to be adequate. What is then called for is *holonomy*, i.e., the law of the whole. Holonomy does not totally deny the relevance of analysis in the sense discussed above. Indeed, 'the law of the whole' will generally include the possibility of describing the 'loosening' of aspects from each other, so that they will be relatively autonomous in limited contexts (as well as the possibility of describing the interactions of these aspects in a system of heteronomy). However, any form of relative autonomy (and heteronomy) is ultimately limited by holonomy, so that in a broad enough context such forms are seen to be merely aspects, relevated in the holomovement, rather than disjoint and separately existent things in interaction.

Scientific investigations have generally tended to begin by relevating apparently autonomous aspects of the totality. The study of the laws of these aspects has generally been emphasized at first, but as a rule this kind of study has led gradually to an awareness that such aspects are related to others originally thought to have no significant bearing on the subject of primary interest.

From time to time, a wide range of aspects has been comprehended within a 'new whole'. But of course the general tendency until now has been to fix on this 'new whole' as a finally valid general order that is henceforth to be adapted (in the manner discussed in section 1) to fit any further facts that may be observed or discovered.

It is implied here, however, that even such a 'new whole' will itself be revealed as an aspect in yet another new whole. Thus, holonomy is not to be regarded as a fixed and final goal of scientific research, but rather as a movement in which 'new wholes' are continually emerging. And of course this further

implies that the total law of the undefinable and immeasurable holomovement could never be known or specified or put into words. Rather, such a law has necessarily to be regarded as *implicit*.

The general question of the assimilation of the overall fact in physics in such a notion of law will now be discussed.

APPENDIX: IMPLICATE AND EXPLICATE ORDER IN PHYSICAL LAW

A.1 Introduction

In this appendix, the notions of implicate and explicate order that have been introduced earlier will be put into a more mathematical form.

It is important to emphasize, however, that mathematics and physics are not being regarded here as separate but mutually related structures (so that, for example, one could be said to apply mathematics to physics as paint is applied to wood). Rather, it is being suggested that mathematics and physics are to be considered as aspects of a single undivided whole.

In discussing this whole, we begin with the general language which is used for description in physics. We may then be said to *mathematize* this language, i.e. to articulate or define it in more detail so that it allows statements of greater precision from which a broad range of significant inferences may be drawn in a clear and coherent way.

In order that the general language and its mathematization shall be able to work together coherently and harmoniously, these two aspects have to be similar to each other in certain key ways, though they will, of course, be different in other ways (notably in that the mathematical aspect has greater possibilities for precision of inferences). Through a consideration of these similarities and differences, there can arise what may be called a

sort of 'dialogue' in which new meanings common to both aspects are created. It is in this 'dialogue' that the wholeness of the general language and its mathematics is to be seen.

In this appendix we shall then indicate, though only in a very preliminary and provisional way, how we can mathematize the general language for developing implicate and explicate orders in a coherent and harmonious manner.

A.2 Euclidean systems of order and measure

We begin with the mathematical description of explicate order.

Now, explicate order arises primarily as a certain aspect of sense perception and of experience with the content of such sense perception. It may be added that, in physics, explicate order generally reveals itself in the sensibly observable results of functioning of an instrument.

What is common to the functioning of instruments generally used in physical research is that the sensibly perceptible content is ultimately describable in terms of a Euclidean system of order and measure, i.e., one that can adequately be understood in terms of ordinary Euclidean geometry. We shall therefore begin with a discussion of Euclidean systems of order and measure.

In this discussion, we shall adopt the well-known view of the mathematician Klein, who considers the general transformations to be the essential determining features of a geometry. Thus, in a Euclidean space of three dimensions, there are three displacement operators D_i. Each of these operators defines a set of parallel lines which transform into themselves under the operation in question. Then, there are three rotation operators R_i. Each of these defines a set of concentric cylinders around the origin which transform into themselves under the operation in question. Together, they define concentric spheres which transform into themselves under the whole set of R_i. Finally, there is the dilatation operator R_0, which transforms a sphere of a given

radius into one of a different radius. Under this operation, the radial lines through the origin transform into themselves.

From any one set of operators R_i, R_0 we obtain another set R'_i, R'_0, corresponding to a different centre, by means of a displacement

$$(R'_i, R'_0) = D_j(R_i, R_0)\ D_j^{-1}.$$

From the D_i, we obtain a set of displacements D'_i in new directions by the rotation

$$D'_i = R_j D_i R_j^{-1}.$$

Now, if D_i is a certain displacement, $(D_i)^n$ will be a displacement of n similar steps. This means that displacements can be ordered naturally in an order similar to that of the integers. So we may describe displacements on a *numerical* scale. This gives not only an *order*, but also a *measure* (in so far as we treat successive displacements as equivalent in size).

Similarly, each rotation R_i determines an ordered and measured series $(R_i)^n$ of rotations, while a dilation R_0 determines an ordered and measured series $(R_0)^n$ of dilations.

It is clear that operations of this kind determine what is meant by parallelism and perpendicularity, as well as what is meant by congruence and similarity of geometric figures. Thus, they determine the essential feature of a Euclidean geometry, with its whole system of order and measure. It has to be kept in mind, however, that the whole set of operations is what is being taken as primarily relevant, while static elements (e.g., straight lines, circles, triangles, etc.) are now being regarded as 'invariant subspaces' of the operations and as configurations formed from these subspaces.

A.3 Transformation and metamorphosis

We now discuss the mathematical description of implicate order. Implicate order is generally to be described not in terms of simple geometric transformations, such as translations, rotations, and dilations, but rather in terms of a different kind of operation. In the interests of clarity, we shall therefore reserve the word *transformation* to describe a simple geometric change *within* a given explicate order. What happens in the broader context of implicate order we shall then call a *metamorphosis*. This word indicates that the change is much more radical than the change of position of orientation of a rigid body, and that it is in certain ways more like the changes from caterpillar to butterfly (in which everything alters in a thorough going manner while some subtle and highly implicit features remain invariant). Evidently, the change between an illuminated object and its hologram (or between an ink droplet and the 'grey mass' obtained by stirring it) is to be described as a metamorphosis rather than as a transformation.

We shall use the symbol M for a metamorphosis and T for a transformation, while E denotes a whole set of transformations that are relevant in a given explicate order (D_i, R_i, R_0). Under a metamorphosis, the set E will change into another set E given by

$$E' = MEM^{-1}.$$

This has hitherto generally been called a similarity transformation but from now on it will be called a similarity metamorphosis.

To indicate the essential features of a similarity metamorphosis, let us consider the example of the hologram. In this case, the appropriate metamorphosis M is determed by the Green's function relating amplitudes at the illuminated structure to those at the photographic plate. For waves of definite frequency ω the Green's function is

$$G(\mathbf{x}-\mathbf{y}) \simeq \{\exp[i(\omega/c)|\mathbf{x}-\mathbf{y}|]\}/|\mathbf{x}-\mathbf{y}|$$

where **x** is a coordinate relevant to the illuminated structure and **y** is one relevant to the plate. Thus, if $A(\mathbf{x})$ is the amplitude of the wave at the illuminated structure, then the amplitude $B(\mathbf{y})$ at the plate is

$$B(\mathbf{y}) \simeq \int (\{\exp[i(\omega/c)|\mathbf{x}-\mathbf{y}|]\}/|\mathbf{x}-\mathbf{y}|)\, A(\mathbf{x})\, d\mathbf{x}.$$

The entire illuminated structure is seen from the above equation to be 'carried' and 'enfolded' in each region of the plate in a way that evidently cannot be described in terms of a point-to-point transformation or correspondence between **x** and **y**. The matrix $M(\mathbf{x}, \mathbf{y})$, which is essentially $G(\mathbf{x} - \mathbf{y})$, can thus be called a metamorphosis of the amplitudes at the illuminated structure into the amplitudes at the hologram.

Let us now consider the relationship between transformation E in the illuminated structure and concomitant changes in the hologram which follow these transformations. In the illuminated structure, E can be characterized as a point-to-point correspondence in which any similar locality is transformed into a similar locality. The corresponding change in the hologram is described by $E' = MEM^{-1}$. This is not a correspondence of points *in the hologram* to each other in which the property of locality of such sets of points would be preserved. Rather, each region of the hologram is changed in a way that depends on all other such regions. Nevertheless, the change E' in the hologram evidently determines the change E in the structure that can be seen when the hologram is illuminated with laser light.

Likewise, in a quantum context a unitary transformation (e.g., as given by a Green's function operating on the state vector) can be understood as a metamorphosis in which point-to-point transformations of space and time that preserve locality are 'enfolded' into more general operations that are *similar* in the

sense defined above and which nevertheless are not locality-preserving point-to-point transformations.

A.4 Mathematization of the description of implicate order

The next step is to discuss the mathematization of the language for the description of implicate order.

We begin by considering a metamorphosis M. By applying M again and again, we obtain $(M)^n$, which describes the enfolding of a given structure n times. If we then write $Q_n = (M)^n$, we have

$$Q_n : Q_{n-1} = Q_{n-1} : Q_{n-2} = M.$$

Thus, there is a series of similar differences in the Q_n (indeed, the differences are not only similar but are also all equal to M). As pointed out in chapter 5, such a series of similar differences indicates an *order*. Since the differences are in the degree of implication, this order is an implicate order. Moreover, in so far as successive operations M are regarded as equivalent, there is also a *measure*, in which n can be taken as an implication parameter.

If we think of the example of droplets of insoluble dye stirred into a viscous fluid (so that we let M describe the change of the droplet when the system is enfolded by a certain number of turns), then M^n describes the change of the droplet when subjected to n enfoldings. Each droplet is, however, inserted in a position that is displaced by a certain amount relative to the proceeding droplet. Let this displacement be denoted by D. The nth droplet first suffers the displacement D^n and then the metamorphosis is M^n, so that the net result is given by $M^n D^n$. Let us further suppose that the density of dye injected with each droplet can vary, and denote that of the dye injected into the nth droplet with the aid of the operation $Q_n = C_n M^n D^n$. The operator corresponding to the entire series of droplets is obtained by adding the contributions of each, to give

$$Q = \sum_n C_n M^n D^n.$$

Moreover, any number of structures, corresponding to Q, Q', Q'', etc., can also be superposed, to yield

$$R = Q + Q' + Q'' + \ldots .$$

In addition, any such structure can itself undergo a displacement, such as D, and a metamorphosis, such as M, to yield

$$R' = MDR.$$

If the fluid were already a 'uniformly grey' background, we could give meaning to a negative coefficient C_n as signifying the *removal* of a certain amount of dye from a region corresponding to a droplet (rather than to the addition of such dye to the region).

In the above discussion, each mathematical symbol corresponds to an operation (transformation and/or metamorphosis). There is a meaning to adding operations, to multiplying the result by a number C, and to multiplying operations by each other. If we further introduce a unit operation (one which leaves all operations unaltered in multiplication) and a zero operation (one which leaves all operations unaltered when added), we will have satisfied all the conditions needed for an algebra.

We see, then, that an algebra contains key features which are similar to the key features of structures built on implicate orders. Such an algebra thus makes possible a *relevant mathematization* that can be coherently related to the general language for discussing implicate orders.

Now, in the quantum theory an algebra similar to the one described above also plays a key role. Indeed, the theory is

expressed in terms of linear operators (including a unit operator and a zero operator) that can be added to each other, multiplied by numbers, and multiplied by each other. All the content of the quantum theory can thus be put in terms of such an algebra.

Of course, in the quantum theory, the algebraic terms are interpreted as standing for 'physical observables' to which they correspond. However, in the approach that is being suggested here, such terms are not to be regarded as standing for anything in particular. Rather, they are to be considered as extensions of the general language. A single algebraic symbol is thus similar to a word, in the sense that its implicit meaning comes out fully only in the way in which the language as a whole is used.

This approach is indeed used in a great deal of modern mathematics,[4] especially in number theory. Thus, one can start with what are called *undefinable symbols*. The meaning of such a symbol is never directly relevant. Rather, only relationships and operations in which these symbols take part are relevant.

What we are proposing here is that as we mathematize language in the way indicated above, there will arise orders, measures, and structures within the language which are similar to (but also different from) orders, measures, and structures that are to be perceived in common experience and in experience with the functioning of scientific instruments. As further indicated above, there can be a relationship between these two kinds of orders, measures, and structures, so that what we talk about and think about will have a common ratio or reason with what we can observe and do (see chapter 5 for a discussion of this sense of 'ratio' or 'reason').

This means, of course, that we do not regard terms like 'particle', 'charge', 'mass', 'position', 'momentum', etc., as having primary relevance in the algebraic language. Rather, at best, they will have to come out as high-level abstractions. As pointed out in this section, the real meaning of the 'quantum algebra' will then be that it is a mathematization of the general language,

which enriches the latter and makes possible a more precisely articulated discussion of implicate order than is possible in terms of the general language alone.

Of course, algebra is in itself a limited form of mathematization. There is no reason in principle why we should not ultimately go on to other sorts of mathematization (involving, for example, rings and lattices or still more general structures which have yet to be created). However, it will be seen in this appendix that even within the limits of an algebraic structure, one can assimilate a very wide range of aspects of modern physics, and one can open up a great many interesting new avenues for exploration. It is therefore useful to go into the algebraic mathematization of the common language in some detail before going into more general kinds of mathematization.

A.5 Algebra and the holomovement

We begin our exploration of the algebraic mathematization of the general language by calling attention to the fact that the primary meaning of an algebraic symbol is that it describes a certain kind of movement.

Thus, consider the set of undefinable algebraic terms denoted by A. It is characteristic of an algebra that these terms have a relationship given by

$$A_i A_j = \sum_k \lambda^K_{I\,j} A_K$$

where $\lambda^K_{I\,j}$ is a set of numerical constants. This relationship means that when a given term A_i precedes another one A_j, the result is equivalent to a 'weighted sum' or superposition of terms (so that an algebra contains a sort of 'superposition principle' similar in key ways to that which holds in the quantum theory). In effect, one can say that although the term A_i is 'in itself'

undefinable, it nevertheless signifies a certain sort of 'movement' of the total set of terms, in which each symbol A_j is replaced by (or changes into) a superposition of symbols $\Sigma\lambda^{K}_{1j}A_k$.

As pointed out earlier, however, in the general language for the description of implicate order the undefinable and immeasurable holomovement is considered as the totality in which all that is to be discussed is ultimately to be relevated. Similarly, in the algebraic mathematization of this general language, we consider as a totality an undefinable algebra in which the primary meaning of each term is that it signifies a 'whole movement' in all the terms of the algebra. Through this key similarity there arises the possibility of a coherent mathematization of the sort of general description that takes the totality to be the undefinable and immeasurable holomovement.

We can now go further along these lines. Thus, just as in the general language, we can consider relatively autonomous aspects of the holomovement, so in its mathematization, we can consider relatively autonomous sub-algebras which are aspects of the undefinable 'whole algebra'. As each aspect of the holomovement is ultimately limited in its autonomy by the law of the whole (i.e., the holonomy), so each sub-algebra is ultimately limited by the fact that the relevant law involves movements going outside those that can be described in terms of the sub-algebra in question.

A given physical context will then be describable in terms of an appropriate sub-algebra. As we approach the limits of this context, we will discover that such a description is inadequate and we will consider broader algebras until we find a description that is adequate to the new context to which we have thus been led.

In the context of classical physics, for example, it is possible to abstract a sub-algebra corresponding to a set of Euclidean operations E. However, in a 'quantum' context, the 'law of the whole' involves metamorphoses M which lead out of this sub-algebra

and into different (but similar) sub-algebras given by

$$E' = MEM^{-1}.$$

As pointed out, there are now indications that even the 'quantum' algebra is inadequate in yet broader contexts. So it is natural to go on to consider still broader algebras (and ultimately, of course, yet more general sorts of mathematization that may prove to be relevant).

A.6 Extension of principle of relativity to implicate orders

As a step into the inquiry into more comprehensive forms of mathematization, we shall point out the possibility of a certain extension of the principle of relativity to implicate orders that is suggested by considering how the quantum algebra limits the autonomy of the classical algebra in the way described above.

Now, in a classical context, any structure can be specified in terms of a set of operations E_1, E_2, E_3, . . . (which describe lengths, angles, congruence, similarity, etc.). When we go to a broader, 'quantum' content, we can arrive at similar operations, $E' = MEM^{-1}$. What this similarity means is that if any two elements, say E_1 and E_2, are related in a certain way in the description of a specified structure, then there is a set of elements E_1' and E_2' describing non-local 'enfolded' transformations that are related in a similar way. Or, to put it more concisely,

$$E_1 : E_2 :: E_1' : E_2'.$$

From this, it follows that if we are given a Euclidean system of order and measure with certain structures that are built on it, we can always obtain another system E' enfolded to relative E, and yet capable of having similar structures built on it.

Hitherto, the principle of relativity has taken a form which

may be put as follows: 'Given any structural relationship as described in a frame of coordinates corresponding to a certain velocity, it is always possible to have a similar structural relationship as described in a frame of coordinates corresponding to any other velocity.' It follows from the discussion above, however, that the mathematization of the general language in terms of a 'quantum' algebra opens up the possibility of an extension of the principle of relativity. Such an extension is evidently similar to the principle of complementarity, in that when conditions are such that a given order corresponding to a set of operations E is explicate, then another order corresponding to similar operations $E' = MEM^{-1}$ is implicate (so that in a certain sense both orders cannot be defined together). However, it is different from the principle of complementarity in that the primary emphasis is now on orders and measures that are relevant to geometry, rather than on mutually incompatible experimental arrangements.

It follows from this extension of the principle of relativity that the idea of space as constituted of a set of unique and well-defined points, related topologically by a set of neighbourhoods and metrically by a definition of distance, is no longer adequate. Indeed, each set of Euclidean operations E' defines such a set of points, neighbourhoods, measures, etc., which are implicate relative to those defined by another set E'. The notion of space as a set of points with a topology and a metric is thus merely an aspect of a broader totality.

It will be helpful here to introduce a further new usage of language. In topology one can describe a space as covered by a *complex*, constituted of elementary figures (e.g. triangles or other basic polygonal cell forms), each of which is called a simplex. The word 'plex' is a form of the Latin 'plicare', which, as we have already seen, means 'to fold'. So, 'simplex' means 'one-fold' and 'complex' means 'folded together', but in the sense of many separate objects that are joined to each other.

To describe the enfolding of an unlimited set of Euclidean systems of orders and measures into each other, we may then introduce the word *multiplex* (which is new in this context). This means 'many complexes all folded together'. Literally, this is also what is meant by 'manifold'. However, by custom, this last word has come to mean 'continuum'. So we are led to use the word multiplex to call attention to the primary relevance of implicate order and to the inadequacy of a description in terms of a continuum.

Thus far, space has generally been considered as a continuum that can be covered by a complex (which is evidently a form of explicate ordering of the space). Such a complex can be discussed in terms of coordinate systems. Thus, each simplex can be described with the aid of a locally Euclidean frame, and the whole space can then be treated through the use of a very large number of overlapping coordinate 'patches'. Or, alternatively, one may find a single set of curvilinear coordinates that is applicable over the entire space. The principle of relativity then states that all such coordinate systems furnish equivalent frames of description (i.e. equivalent for the expression of ratio, or reason, or law).

We can now go on to consider similar sets of operations E and E' which are implicate relative to each other. As pointed out above, we are extending the principle of relativity by supposing that the orders defined through any two operations E and E' are equivalent in the sense that the 'law of the whole' is such that similar structures can be built on each order. To help make clear what is meant here, we note that the orders of movement that are directly perceivable to the senses are generally regarded as explicate, while other orders (such as, for example, those appropriate to the description of 'an electron' in a quantum context), are taken to be implicate. However, according to the extended principle of relativity, one can equally well take the 'electron' order as explicate and our sensual order as implicate.

This is to put ourselves (metaphorically) in the situation of ‘the electron’ and then to understand the latter by assimilating oneself to it and it to oneself.

This evidently means a thoroughgoing wholeness in our thinking. Or, as put earlier, ‘All implicates all’, even to the extent that ‘we ourselves’ are implicated together with ‘all that we see and think about’. So we are present everywhere and at all times, though only implicately (that is, implicitly).

The same is true of every ‘object’. It is only in certain special orders of description that such objects appear as explicate. The general law, i.e., holonomy, has to be expressed in all orders, in which all objects and all times are ‘folded together’.

A.7 Some preliminary suggestions concerning law in a multiplex

We shall now give a few preliminary suggestions as to the lines of inquiry into general law as formulated in terms of a multiplex rather than in terms of a continuum.

We begin by recalling that classical descriptions are relevant only in a context in which the expression of the law is limited to a particular sub-algebra corresponding to a given Euclidean system of order and measure. If this system is extended to time as well as space, then such a law can be compatible with special relativity.

The essential feature of special relativity is that the speed of light is an invariant limit for the propagation of signals (and causal influences). In this connection, we note that a signal will always be constituted of a certain explicate order of events, and that in a context in which this explicate order ceases to be relevant, the notion of signal will also cease to be relevant (e.g., if an order is ‘enfolded’ throughout all of space and time, it cannot coherently be regarded as constituting a signal that would propagate information from one place to another over a period

of time). This means that where implicate order is involved, the descriptive language of special relativity will, in general, no longer be applicable.

The general theory of relativity is similar to the special theory, in that in each region of space–time there is a light cone which defines a limiting signal velocity. It is different, however, in that each region has its own local coordinate frame (denoted by m) related to those of its neighbours (denoted by n) through certain general linear transformations T_{mn}. But a local coordinate frame is, in our point of view, to be regarded as an expression of a corresponding Euclidean system of order and measure (which would, for example, generate the lines of the frame in question as invariant subspaces of the operations E). We therefore consider the Euclidean systems of operations E_m and E_n and the transformations relating them:

$$E_n = T_{mn} E_m T_{mn}^{-1}.$$

When we consider a series of transformations of these systems around a closed circuit of patches, we arrive at what is in mathematical terms called the 'holonomy group'. In one sense, this name is appropriate, for this group does determine the character of the 'whole space'. Thus, in general relativity, this group is equivalent to the Lorentz group, which is compatible with the requirement of an invariant 'local light cone'. The use of a different group here would of course imply a correspondingly different character to the 'whole space'.

In another sense, however, it would be better to consider the group in question as an 'autonomy group' rather than as a 'holonomy group', for, in general relativity (as well as in a wide class of modern field theories), the general law is invariant to arbitrary 'gauge transformations' of the frames in each region, $E_m{}' = R_m E_m R_m^{-2}$. The meaning of these transformations can be seen by considering several neighbouring regions, each containing a

localized structure, i.e., one which has a negligible connection with neighbouring structures (so that one may appropriately regard the space between them as empty, or approximately so). The significance of gauge invariance is then that the laws are such that any two structures can be transformed independently of each other, at least within certain limits (e.g., as long as there is sufficient 'empty space' between them). An example of such relative autonomy of structures is that objects that are not too close can be turned and translated relative to each other. Evidently, it is this particular feature of 'law of the whole' (i.e., gauge invariance) which allows for relative autonomy of the kind described above.

As we go on to a quantum context, the 'law of the whole' (i.e., the generalization of what is meant by 'holonomy group' in Rieman geometry) will involve metamorphosis M as well as transformations *T*. This will bring us to the multiplex, in which new kinds of order and measure will be relevant.

It is important, however, to emphasize that the 'law of the whole' will not just be a transcription of current quantum theory to a new language. Rather, the entire context of physics (classical and quantum) will have to be assimilated in a different structure, in which space, time, matter, and movement are described in new ways. Such assimilation will then lead on to new avenues to be explored, which cannot even be thought about in terms of current theories.

We shall here indicate only a few of the many possibilities of this kind.

First, we recall that we begin with an undefinable total algebra and take out sub-algebras that are suitable for the description of certain contexts of physical research. Now, mathematicians have already worked out certain interesting and potentially relevant features of such sub-algebras.

Thus, consider a given sub-algebra A. Among its terms A_i, there may be some A_N which are nilpotent, i.e., which have the

property that some powers of A_N (say $(A_N)^s$) are zero. Among these, there is a subset of terms A_p which are *properly nilpotent*, i.e. which remain nilpotent when multiplied by any term of the algebra A_i (so that $(A_iA_p)^s = 0$).

As an example, consider first a clifford algebra, in which every term is properly nilpotent. However, in a fermionic algebra, with terms C_i and $C_j{}^*$, each C_i and $C_j{}^*$ is nilpotent (i.e., $(C_i)^2 = (C_j{}^*)^2 = 0$) but not properly nilpotent (i.e., $(C_i{}^* C_j)^2 \neq 0$).

One may say that properly nilpotent terms describe movements which ultimately lead to features that vanish. Thus, if we are seeking to describe invariant and relatively permanent features of movement, we should have an algebra that has no properly nilpotent terms. Such an algebra can always be obtained from any algebra A by subtracting the properly nilpotent terms to give what is called the *difference algebra*.

We now consider the following theorem.[5] Every different algebra can be expressed in terms of products of a matrix algebra (i.e., an algebra whose rules of multiplication are similar to those of matrices) and a division algebra (i.e., an algebra in which the product of two non-zero terms is never zero).

As regards the division algebra, the possible types of these depend on the fields over which the numerical coefficients are taken. If this field is that of the real numbers, then there are exactly three division algebras, the real numbers themselves, an algebra of order two, which is equivalent to complex numbers, and the real quaternions. On the other hand, over the field of complex numbers, the only division algebra is that of the complex numbers themselves (this explains why quaternions, extended to include complex coefficients, become a two-rowed matrix algebra).

It is significant that by mathematizing the general language in terms of an initially undefined and unspecified algebra, we arrive naturally at the sort of algebras used in current quantum theory for 'particles with spin', i.e. products of matrices and

quaternions. These algebras have in addition, however, a significance going beyond that of technical calculations carried out in the quantum theory. For example, the quaternions imply invariance under a group of transformations similar to rotations in three-dimensional space (which can be extended in a simple way to groups similar to the Lorentz group). This indicates that, in some sense, the key transformations determining the (3 + 1)-dimensional order of 'relativist space–time' are already contained in the holomovement, described through implicate order, mathematized in terms of algebra.

More precisely, it can be said that, starting from a general algebraic mathematization of the language and asking for those features which are relatively permanent or invariant (described by algebras without properly nilpotent terms) and those features which are not restricted to a particular scale (described by algebras whose terms can be multiplied by an arbitrary real number), we have arrived at transformations determining an order equivalent to that of relativistic space–time. This means, however, that if we considered impermanent and non-invariant features (implying algebras with properly nilpotent terms) and features that are restricted to particular scales (implying algebras over the rationals or over finite number fields), then entirely new orders (not reducible at all to (3 + 1)-dimensional order) may become relevant. It thus becomes clear that there is here a wide area for possible exploration.

A further area for exploration would be in the development of a new description combining classical and quantum aspects in a single or more comprehensive structure of language. Instead of regarding classical and quantum languages as separate but related by some sort of correspondence (as is generally done in current theories), one can, along the lines already indicated in this appendix, inquire into the possibility of abstracting these as limiting cases of languages mathematized in terms of broader algebras. To do this could evidently lead to different theories,

having a new content, going beyond those of both classical and quantum theories. In this regard, it would be particularly interesting to see if algebraic structures would be discovered which lead also to relativistic notions as limiting cases (e.g., in terms of algebras over finite number fields, rather than over the reals). Such theories might be expected to be free of the infinities of current theories, and to lead to a generally coherent treatment of the problems that the current theories cannot solve.

7

THE ENFOLDING-UNFOLDING UNIVERSE AND CONSCIOUSNESS

1 INTRODUCTION

Throughout this book the central underlying theme has been the unbroken wholeness of the totality of existence as an undivided flowing movement without borders.

It seems clear from the discussion in the previous chapter that the implicate order is particularly suitable for the understanding of such unbroken wholeness in flowing movement, for in the implicate order the totality of existence is enfolded within each region of space (and time). So, whatever part, element, or aspect we may abstract in thought, this still enfolds the whole and is therefore intrinsically related to the totality from which it has been abstracted. Thus, wholeness permeates all that is being discussed, from the very outset.

In this chapter we shall give a non-technical presentation of the main features of the implicate order, first as it arises in

physics, and then as it may be extended to the field of consciousness, to indicate certain general lines along which it is possible to comprehend both cosmos and consciousness as a single unbroken totality of movement.[1]

2 RÉSUMÉ, CONTRASTING MECHANISTIC ORDER IN PHYSICS WITH IMPLICATE ORDER

It will be helpful to begin by giving a résumé of some of the main points that have been made earlier, contrasting the generally accepted mechanistic order in physics and the implicate order.

Let us first consider the mechanistic order. As indicated in chapters 1 and 5, the principal feature of this order is that the world is regarded as constituted of entities which are *outside of each other*, in the sense that they exist independently in different regions of space (and time) and interact through forces that do not bring about any changes in their essential natures. The machine gives a typical illustration of such a system of order. Each part is formed (e.g., by stamping or casting) independently of the others, and interacts with the other parts only through some kind of external contact. By contrast, in a living organism, for example, each part grows in the context of the whole, so that it does not exist independently, nor can it be said that it merely 'interacts' with the others, without itself being essentially affected in this relationship.

As pointed out in chapter 1, physics has become almost totally committed to the notion that the order of the universe is basically mechanistic. The most common form of this notion is that the world is assumed to be constituted of a set of separately existent, indivisible and unchangeable 'elementary particles', which are the fundamental 'building blocks' of the entire universe. Originally, these were thought to be atoms, but atoms were eventually divided into electrons, protons and neutrons.

These latter were thought to be the absolutely unchangeable and indivisible constituents of all matter, but then, these were in turn found to be subject to transformation into hundreds of different kinds of unstable particles, and now even smaller particles called 'quarks' and 'partons' have been postulated to explain these transformations. Though these have not yet been isolated there appears to be an unshakable faith among physicists that either such particles, or some other kind yet to be discovered, will eventually make possible a complete and coherent explanation of everything.

The theory of relativity was the first significant indication in physics of the need to question the mechanistic order. As explained in chapter 5, it implied that no coherent concept of an independently existent particle is possible, neither one in which the particle would be an extended body, nor one in which it would be a dimensionless point. Thus, a basic assumption underlying the generally accepted form of mechanism in physics has been shown to be untenable.

To meet this fundamental challenge, Einstein proposed that the particle concept no longer be taken as primary, and that instead reality be regarded from the very beginning as constituted of fields, obeying laws that are consistent with the requirements of the theory of relativity. A key new idea of this 'unified field theory' of Einstein is that the field equations be *non-linear*. As stated in chapter 5, these equations could have solutions in the form of localized pulses, consisting of a region of intense field that could move through space stably as a whole, and that could thus provide a model of the 'particle'. Such pulses do not end abruptly but spread out to arbitrarily large distances with decreasing intensity. Thus the field structures associated with two pulses will merge and flow together in one unbroken whole. Moreover, when two pulses come close together, the original particle-like forms will be so radically altered that there is no longer even a resemblance to a structure consisting

of two particles. So, in terms of this notion, the idea of a separately and independently existent particle is seen to be, at best, an abstraction furnishing a valid approximation only in a certain limited domain. Ultimately, the entire universe (with all its 'particles', including those constituting human beings, their laboratories, observing instruments, etc.) has to be understood as a single undivided whole, in which analysis into separately and independently existent parts has no fundamental status.

As has been seen in chapter 5, however, Einstein was not able to obtain a generally coherent and satisfactory formulation of his unified field theory. Moreover (and perhaps more important in the context of our discussion of the mechanistic approach to physics) the field concept, which is his basic starting point, still retains the essential features of a mechanistic order, for the fundamental entities, the fields, are conceived as existing outside of each other, at separate points of space and time, and are assumed to be connected with each other only through external relationships which indeed are also taken to be local, in the sense that only those field elements that are separated by 'infinitesimal' distances can affect each other.[2]

Though the unified field theory was not successful in this attempt to provide an ultimate mechanistic basis for physics in terms of the field concept, it nevertheless did show in a concrete way how consistency with the theory of relativity may be achieved by deriving the particle concept as an abstraction from an unbroken and undivided totality of existence. Thus, it helped to strengthen the challenge posed by relativity theory to the prevailing mechanistic order.

The quantum theory presents, however, a much more serious challenge to this mechanistic order, going far beyond that provided by the theory of relativity. As seen in chapter 5, the key features of the quantum theory that challenge mechanism are:

1 Movement is in general *discontinuous*, in the sense that action is constituted of *indivisible quanta* (implying also that an electron, for example, can go from one state to another, without passing through any states in between).
2 Entities, such as electrons, can show different properties (e.g., particle-like, wavelike, or something in between), depending on the environmental context within which they exist and are subject to observation.
3 Two entities, such as electrons, which initially combine to form a molecule and then separate, show a peculiar non-local relationship, which can best be described as a non-causal connection of elements that are far apart[3] (as demonstrated in the experiment of Einstein, Podolsky and Rosen[4]).

It should be added of course that the laws of quantum mechanics are statistical and do not determine individual future events uniquely and precisely. This is, of course, different from classical laws, which do in principle determine these events. Such indeterminism is, however, not a serious challenge to a mechanistic order, i.e., one in which the fundamental elements are independently existent, lying outside each other, and connected only by external relationships. The fact that (as in a pinball machine) such elements are related by the rules of chance (expressed mathematically in terms of the theory of probability) does not change the basic externality of the elements[5] and so does not essentially affect the question of whether the fundamental order is mechanistic or not.

The three key features of the quantum theory given do, however, clearly show the inadequacy of mechanistic notions. Thus, if all actions are in the form of discrete quanta, the interactions between different entities (e.g., electrons) constitute a single structure of indivisible links, so that the entire universe has to be thought of as an unbroken whole. In this whole, each element

that we can abstract in thought shows basic properties (wave or particle, etc.) that depend on its overall environment, in a way that is much more reminiscent of how the organs constituting living beings are related, than it is of how parts of a machine interact. Further, the non-local, non-causal nature of the relationships of elements distant from each other evidently violates the requirements of separateness and independence of fundamental constituents that is basic to any mechanistic approach.

It is instructive at this point to contrast the key features of relativistic and quantum theories. As we have seen, relativity theory requires continuity, strict causality (or determinism) and locality. On the other hand, quantum theory requires non-continuity, non-causality and non-locality. So the basic concepts of relativity and quantum theory directly contradict each other. It is therefore hardly surprising that these two theories have never been unified in a consistent way. Rather, it seems most likely that such a unification is not actually possible. What is very probably needed instead is a qualitatively new theory, from which both relativity and quantum theory are to be derived as abstractions, approximations and limiting cases.

The basic notions of this new theory evidently cannot be found by beginning with those features in which relativity and quantum theory stand in direct contradition. The best place to begin is with what they have basically in common. This is undivided wholeness. Though each comes to such wholeness in a different way, it is clear that it is this to which they are both fundamentally pointing.

To begin with undivided wholeness means, however, that we must drop the mechanistic order. But this order has been, for many centuries, basic to all thinking on physics. As brought out in chapter 5, the mechanistic order is most naturally and directly expressed through the Cartesian grid. Though physics has changed radically in many ways, the Cartesian grid (with minor

modifications, such as the use of curvilinear coordinates) has remained the one key feature that has not changed. Evidently, it is not easy to change this, because our notions of order are pervasive, for not only do they involve our thinking but also our senses, our feelings, our intuitions, our physical movement, our relationships with other people and with society as a whole and, indeed, every phase of our lives. It is thus difficult to 'step back' from our old notions of order sufficiently to be able seriously to consider new notions of order.

To help make it easier to see what is meant by our proposal of new notions of order that are appropriate to undivided wholeness, it is therefore useful to start with examples that may directly involve sense perception, as well as with models and analogies that illustrate such notions in an imaginative and intuitive way. In chapter 6 we began by noting that the photographic lens is an instrument that has given us a very direct kind of sense perception of the meaning of the mechanistic order, for by bringing about an approximate correspondence between points on the object and points on the photographic image, it very strongly calls attention to the separate elements into which the object can be analysed. By making possible the point-to-point imaging and recording of things that are too small to be seen with the naked eye, too big, too fast, too slow, etc., it leads us to believe that eventually everything can be *perceived* in this way. From this grows the idea that there is nothing that cannot also be *conceived* as constituted of such localized elements. Thus, the mechanistic approach was greatly encouraged by the development of the photographic lens.

We then went on to consider a new instrument, called the *hologram*. As explained in chapter 6, this makes a photographic record of the interference pattern of light waves that have come off an object. The key new feature of this record is that each part contains information about the *whole object* (so that there is no point-to-point correspondence of object and recorded image).

That is to say, the form and structure of the entire object may be said to be *enfolded* within each region of the photographic record. When one shines light on any region, this form and structure are then *unfolded* to give a recognizable image of the whole object once again.

We proposed that a new notion of order is involved here, which we called the *implicate order* (from a Latin root meaning 'to enfold' or 'to fold inward'). In terms of the implicate order one may say that everything is enfolded into everything. This contrasts with the *explicate order* now dominant in physics in which things are *unfolded* in the sense that each thing lies only in its own particular region of space (and time) and outside the regions belonging to other things.

The value of the hologram in this context is that it may help to bring this new notion of order to our attention in a sensibly perceptible way; but of course, the hologram is only an instrument whose function is to make a static record (or 'snapshot') of this order. The actual order itself which has thus been recorded is in the complex movement of electromagnetic fields, in the form of light waves. Such movement of light waves is present everywhere and in principle enfolds the entire universe of space (and time) in each region (as can be demonstrated in any such region by placing one's eye or a telescope there, which will 'unfold' this content).

As pointed out in chapter 6, this enfoldment and unfoldment takes place not only in the movement of the electromagnetic field but also in that of other fields, such as the electronic, protonic, sound waves, etc. There is already a whole host of such fields that are known, and any number of additional ones, as yet unknown, that may be discovered later. Moreover, the movement is only approximated by the classical concept of fields (which is generally used for the explanation of how the hologram works). More accurately, these fields obey quantum-mechanical laws, implying the properties of discontinuity and non-locality,

which we have already mentioned (and which we shall discuss again later in this chapter). As we shall see later, even the quantum laws may only be abstractions from still more general laws, of which only some outlines are now vaguely to be seen. So the totality of movement of enfoldment and unfoldment may go immensely beyond what has revealed itself to our observations thus far.

In chapter 6 we called this totality by the name *holomovement*. Our basic proposal was then that *what is* is the holomovement, and that everything is to be explained in terms of forms derived from this holomovement. Though the full set of laws governing its totality is unknown (and, indeed, probably unknowable) nevertheless these laws are assumed to be such that from them may be abstracted relatively autonomous or independent subtotalities of movement (e.g., fields, particles, etc.) having a certain recurrence and stability of their basic patterns of order and measure. Such sub-totalities may then be investigated, each in its own right, without our having first to know the full laws of the holomovement. This implies, of course, that we are not to regard what we find in such investigations as having an absolute and final validity, but rather we have always to be ready to discover the limits of independence of any relatively autonomous structure of law, and from this to go on to look for new laws that may refer to yet larger relatively autonomous domains of this kind.

Up till now we have contrasted implicate and explicate orders, treating them as separate and distinct, but as suggested in chapter 6, the explicate order can be regarded as a particular or distinguished case of a more general set of implicate orders from which latter it can be derived. What distinguishes the explicate order is that what is thus derived is a set of recurrent and relatively stable elements that are *outside* of each other. This set of elements (e.g., fields and particles) then provides the explanation of that domain of experience in which the mechanistic order yields an adequate treatment. In the prevailing mechanistic

approach, however, these elements, assumed to be separately and independently existent, are taken as constituting the basic reality. The task of science is then to start from such parts and to derive all wholes through abstraction, explaining them as the results of interactions of the parts. On the contrary, when one works in terms of the implicate order, one begins with the undivided wholeness of the universe, and the task of science is to derive the parts through abstraction from the whole, explaining them as approximately separable, stable and recurrent, but externally related elements making up relatively autonomous sub-totalities, which are to be described in terms of an explicate order.

3 THE IMPLICATE ORDER AND THE GENERAL STRUCTURE OF MATTER

We shall now go on to give a more detailed account of how the general structure of matter may be understood in terms of the implicate order. To do this we shall begin by considering once again the device discussed in chapter 6, which served as an analogy, illustrating certain essential features of the implicate order. (It must be emphasized, however, that it is *only* an analogy and that, as will be brought out in more detail later, its correspondence with the implicate order is limited.)

This device consisted of two concentric glass cylinders, with a highly viscous fluid such as glycerine between them, which is arranged in such a way that the outer cylinder can be turned very slowly, so that there is negligible diffusion of the viscous fluid. A droplet of insoluble ink is placed in the fluid, and the outer cylinder is then turned, with the result that the droplet is drawn out into a fine thread-like form that eventually becomes invisible. When the cylinder is turned in the opposite direction the thread-form draws back and suddenly becomes visible as a droplet essentially the same as the one that was there originally.

It is worth while to reflect carefully on what is actually

happening in the process described above. First, let us consider an element of fluid. The parts at larger radii will move faster than those at smaller radii. Such an element will therefore be deformed, and this explains why it is eventually drawn out into a long thread. Now, the ink droplet consists of an aggregate of carbon particles that are initially suspended in such an element of fluid. As the element is drawn out the ink particles will be carried with it. The set of particles will thus spread out over such a large volume that their density falls below the minimum threshold that is visible. When the movement is reversed, then (as is known from the physical laws governing viscous media) each part of the fluid retraces its path, so that eventually the thread-like fluid element draws back to its original form. As it does so, it carries the ink particles with it, so that eventually they, too, draw together and become dense enough to pass the threshold of perceptibility, so emerging once again as visible droplets.

When the ink particles have been drawn out into a long thread, one can say that they have been *enfolded* into the glycerine, as it might be said that an egg can be folded into a cake. Of course, the difference is that the droplet can be unfolded by reversing the motion of the fluid, while there is no way to unfold the egg (this is because the material here undergoes irreversible diffusive mixing).

The analogy of such enfoldment and unfoldment to the implicate order introduced in connection with the hologram is quite good. To develop this analogy further, let us consider two ink droplets close to each other, and to make visualization easier we will suppose that the ink particles in one droplet are red, while those in the other are blue. If the outer cylinder is then turned, each of the two separate elements of fluid in which the ink particles are suspended will be drawn out into a thread-like form, and the two thread-like forms will, while remaining separate and distinct, weave through each other in a complex

pattern too fine to be perceptible to the eye (rather like the interference pattern that is recorded on the hologram, which has, however, quite a different origin). The ink particles in each droplet will of course be carried along by the fluid motions, but with each particle remaining in its own thread of fluid. Eventually, however, in any region that was large enough to be visible to the eye, red particles from the one droplet and blue particles from the other will be seen to intermingle, apparently at random. When the fluid motions are reversed, however, each thread-like element of fluid will draw back into itself until eventually the two gather into clearly separated regions once again. If one were able to watch what is happening more closely (e.g., with a microscope) one would see red and blue particles that were close to each other beginning to separate, while particles of a given colour that were far from each other would begin to come together. It is almost as if distant particles of a given colour had 'known' that they had a common destiny, separate from that of particles of the other colour, to which they were close.

Of course, there is in this case actually no such 'destiny'. Indeed, we have explained all that has happened mechanically, through the complex movements of the fluid elements in which the ink particles are suspended. But we have to recall here that this device is only an analogy, intended to illustrate a new notion of order. To allow this new notion to stand out clearly, it is necessary to begin by focusing our attention on the ink particles alone, and to set aside the consideration of the fluid in which they are suspended, at least for the moment. When the sets of ink particles from each droplet have been drawn out into an invisible thread, so that particles of both colours intermingle, one can nevertheless say that *as an ensemble* each set is, in a certain way, distinct from the other. This distinction is not in general evident to the senses, but it has a certain relationship to the total situation out of which the ensembles have come. This situation includes the glass cylinders, the viscous fluid and its movements,

and the original distribution of ink particles. It may then be said that each ink particle belongs to a certain distinct ensemble and that it is bound up with the others in this ensemble by the force of an overall necessity, inherent in this total situation, which can bring the whole set to a common end (i.e., to reconstitute the form of a droplet).

In the case of this device, the overall necessity operates mechanically as the movement of fluid, according to certain well-known laws of hydrodynamics. As indicated earlier, however, we will eventually drop this mechanical analogy and go on to consider the holomovement. In the holomovement, there is still an overall necessity (which in chapter 6 we called 'holonomy') but its laws are no longer mechanical. Rather, as pointed out in section 2 of this chapter, its laws will be in a first approximation those of the quantum theory, while more accurately they will go beyond even these, in ways that are at present only vaguely discernible. Nevertheless, certain similar principles of distinction will prevail in the holomovement as in the analogy of the device made up of glass cylinders. That is to say, ensembles of elements which intermingle or inter-penetrate in space can nevertheless be distinguished, but only in the context of certain total situations in which the members of each ensemble are related through the force of an overall necessity, inherent in these situations, that can bring them together in a specifiable way.

Now that we have established a new kind of distinction of ensembles that are enfolded together in space, we can go on to put these distinctions into an *order*. The simplest notion of order is that of a sequence or succession. We shall start with such a simple idea and develop it later to much more complex and subtle notions of order.

As shown in chapter 5, the essence of a simple, sequential order is in the series of relationships among distinct elements:

$$A : B :: B : C :: C : D \ldots.$$

For example, if A represents one segment of a line, B the succeeding one, etc., the sequentiality of segments of the line follows from the above set of relationships.

Let us now return to our ink-in-fluid analogy, and suppose that we have inserted into the fluid a large number of droplets, set close to each other and arranged in a line (this time we do not suppose different colours). These we label as A, B, C, D . . . . We then turn the outer cylinder many times, so that each of the droplets gives rise to an ensemble of ink particles, enfolded in so large a region of space that particles from all the droplets intermingle. We label the successive ensembles A', B', C', D'. . . .

It is clear that, in some sense, an entire linear order has been enfolded into the fluid. This order may be expressed through the relationships

$$A' : B' :: B' : C' :: C' : D' \; . \; . \; . \; .$$

This order is not present to the senses. Yet its reality may be demonstrated by reversing the motion of the fluid, so that the ensembles, A', B', C', D' . . ., will unfold to give rise to the original linearly arranged series of droplets, A, B, C, D . . . .

In the above, we have taken a pre-existent explicate order, consisting of ensembles of ink particles arranged along a line, and transformed it into an order of enfolded ensembles, which is in some key way similar. We shall next consider a more subtle kind of order, not derivable from such a transformation.

Suppose now that we insert an ink droplet, A, and turn the outer cylinder n times. We then insert a second ink droplet, B, at the same place, and again turn the cylinder n times. We keep up this procedure with further droplets, C, D, E . . . . The resulting ensembles of ink particles, a, b, c, d, e, . . ., will now differ in a new way, for, when the motion of the fluid is reversed, the ensembles will successively come together to form droplets in an order opposite to the one in which they were put in. For

example, at a certain stage the particles of ensemble *d* will come together (after which they will be drawn out into a thread again). This will happen to those of *c*, then to *b*, etc. It is clear from this that ensemble *d* is related to *c* as *c* is to *b*, and so on. So these ensembles form a certain sequential order. However, this is in no sense a transformation of a linear order in space (as was that of the sequence A', B', C', D' . . ., that we considered earlier), for in general only one of these ensembles will unfold at a time; when any one is unfolded, the rest are still enfolded. In short, we have an order which cannot all be made explicate at once and which is nevertheless real, as may be revealed when successive droplets become visible as the cylinder is turned.

We call this an *intrinsically implicate order*, to distinguish it from an order that may be enfolded but which can unfold all at once into a single explicate order. So we have here an example of how, as stated in section 2, an explicate order is a particular case of a more general set of implicate orders.

Let us now go on to combine both of the above-described types of order.

We first insert a droplet, *A*, in a certain position and turn the cylinder *n* times. We then insert a droplet, *B*, in a slightly different position and turn the cylinder *n* more times (so that *A* has been enfolded by 2*n* turns). We then insert *C* further along the line *AB* and turn *n* more times, so that *A* has been enfolded by 3*n* turns, *B* 2*n* turns, and *C* by *n* turns. We proceed in this way to enfold a large number of droplets. We then move the cylinder fairly rapidly in the reverse direction. If the rate of emergence of droplets is faster than the minimum time of resolution of the human eye, what we will see is apparently a particle moving continuously and crossing the space.

Such enfoldment and unfoldment in the implicate order may evidently provide a new model of, for example, an electron, which is quite different from that provided by the current mechanistic notion of a particle that exists at each moment only in a

small region of space and that changes its position continuously with time. What is essential to this new model is that the electron is instead to be understood through a total set of enfolded ensembles, which are generally not localized in space. At any given moment one of these may be unfolded and therefore localized, but in the next moment, this one enfolds to be replaced by the one that follows. The notion of continuity of existence is approximated by that of very rapid recurrence of similar forms, changing in a simple and regular way (rather as a rapidly spinning bicycle wheel gives the impression of a solid disc, rather than of a sequence of rotating spokes). Of course, more fundamentally, the particle is only an abstraction that is manifest to our senses. *What is* is always a totality of ensembles, all present together, in an orderly series of stages of enfoldment and unfoldment, which intermingle and inter-penetrate each other in principle throughout the whole of space.

It is further evident that we could have enfolded any number of such 'electrons', whose forms would have intermingled and inter-penetrated in the implicate order. Nevertheless, as these forms unfolded and became manifest to our senses, they would have come out as a set of 'particles' clearly separated from each other. The arrangement of ensembles could have been such that these particle-like manifestations came out 'moving' independently in straight lines, or equally well, along curved paths that were mutually related and dependent, as if there had been a force of interaction between them. Since classical physics traditionally aims to explain everything in terms of interacting systems of particles, it is clear that in principle one could equally well treat the entire domain that is correctly covered by such classical concepts in terms of our model of ordered sequences of enfolding and unfolding ensembles.

What we are proposing here is that in the quantum domain this model is a great deal better than is the classical notion of an interacting set of particles. Thus, although successive localized

manifestations of an electron, for example, may be very close to each other, so that they approximate a continuous track, this need not always be so. In principle, discontinuities may be allowed in the manifest tracks – and these may, of course, provide the basis of an explanation of how, as stated in section 2, an electron can go from one state to another without passing through states in between. This is possible, of course, because the 'particle' is only an abstraction of a much greater totality of structure. This abstraction is what is manifest to our senses (or instruments) but evidently there is no reason why it has to have continuous movement (or indeed continuous existence).

Next, if the total context of the process is changed, entirely new modes of manifestation may arise. Thus, returning to the ink-in-fluid analogy, if the cylinders are changed, or if obstacles are placed in the fluid, the form and order of manifestation will be different. Such a dependence – the dependence of what manifests to observation on the total situation – has a close parallel to a feature which we have also mentioned in section 2, i.e., that according to the quantum theory electrons may show properties resembling either those of particles or those of waves (or of something in between) in accordance with the total situation involved in which they exist and in which they may be observed experimentally.

What has been said thus far indicates that the implicate order gives generally a much more coherent account of the quantum properties of matter than does the traditional mechanistic order. What we are proposing here is that the implicate order therefore be taken as fundamental. To understand this proposal fully, however, it is necessary to contrast it carefully with what is implied in a mechanistic approach based on the explicate order; for, even in terms of this latter approach, it may of course be admitted that in a certain sense at least, enfoldment and unfoldment can take place in various specific situations (e.g., such as that which happens with the ink droplet). However, this sort of situation is not

regarded as having a fundamental kind of significance. All that is primary, independently existent, and universal is thought to be expressible in an explicate order, in terms of elements that are externally related (and these are usually thought to be particles, or fields, or some combination of the two). Whenever enfoldment and unfoldment are found actually to take place, it is therefore assumed that these can ultimately be explained in terms of an underlying explicate order through a deeper mechanical analysis (as, indeed, does happen with the ink-droplet device).

Our proposal to start with the implicate order as basic, then, means that what is primary, independently existent, and universal has to be expressed in terms of the implicate order. So we are suggesting that it is the implicate order that is autonomously active while, as indicated earlier, the explicate order flows out of a law of the implicate order, so that it is secondary, derivative, and appropriate only in certain limited contexts. Or, to put it another way, the relationships constituting the fundamental law are between the enfolded structures that interweave and interpenetrate each other, throughout the whole of space, rather than between the abstracted and separated forms that are manifest to the senses (and to our instruments).

What, then, is the meaning of the appearance of the apparently independent and self-existent 'manifest world' in the explicate order? The answer to this question is indicated by the root of the word 'manifest', which comes from the Latin 'manus', meaning 'hand'. Essentially, what is manifest is what can be held with the hand – something solid, tangible and visibly stable. The implicate order has its ground in the holomovement which is, as we have seen, vast, rich, and in a state of unending flux of enfoldment and unfoldment, with laws most of which are only vaguely known, and which may even be ultimately unknowable in their totality. Thus it cannot be grasped as something solid, tangible and stable to the senses (or to our instruments). Nevertheless, as has been indicated earlier, the

overall law (holonomy) may be assumed to be such that in a certain sub-order, within the whole set of implicate order, there is a totality of forms that have an approximate kind of recurrence, stability and separability. Evidently, these forms are capable of appearing as the relatively solid, tangible, and stable elements that make up our 'manifest world'. The special distinguished sub-order indicated above, which is the basis of the possibility of this manifest world, is then, in effect, what is meant by the explicate order.

We can, for convenience, always picture the explicate order, or imagine it, or represent it to ourselves, as the order present to the senses. The fact that this order *is* actually more or less the one appearing to our senses must, however, be explained. This can be done only when we bring consciousness into our 'universe of discourse' and show that matter in general and consciousness in particular may, at least in a certain sense, have this explicate (manifest) order in common. This question will be explored further when we discuss consciousness in sections 7 and 8.

4 QUANTUM THEORY AS AN INDICATION OF A MULTIDIMENSIONAL IMPLICATE ORDER

Thus far we have been presenting the implicate order as a process of enfoldment and unfoldment taking place in the ordinary three-dimensional space. However, as pointed out in section 2 the quantum theory has a fundamentally new kind of non-local relationship, which may be described as a non-causal connection of elements that are distant from each other, which is brought out in the experiment of Einstein, Podolsky and Rosen.[6] For our purposes, it is not necessary to go into the technical details concerning this non-local relationship. All that is important here is that one finds, through a study of the implications of the quantum theory, that the analysis of a total system into a set of independently existent but interacting particles breaks down

in a radically new way. One discovers, instead, both from consideration of the meaning of the mathematical equations and from the results of the actual experiments, that the various particles have to be taken literally as projections of a higher-dimensional reality which cannot be accounted for in terms of any force of interaction between them.[7]

We can obtain a helpful intuitive sense of what is meant by the notion of projection here, through the consideration of the following device. Let us begin with a rectangular tank full of water, with transparent walls (see Figure 7.1). Suppose further that there are two television cameras, A and B, directed at what is going on in the water (e.g., fish swimming around) as seen through the two walls at right angles to each other. Now let the corresponding television images be made visible on screens A and B in another room. What we will see there is a certain *relationship* between the images appearing on the two screens. For example, on screen A we may see an image of a fish, and on screen B we will see another such image. At any given moment each image will generally *look* different from the other. Nevertheless the differences will be related, in the sense that when one image is seen to execute certain movements, the other will be seen to execute corresponding movements. Moreover, content that is mainly on one screen will pass into the other, and vice versa (e.g., when a fish initially facing camera A turns through a

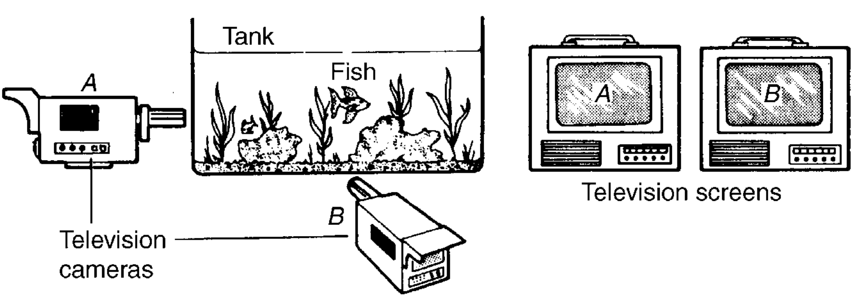

Figure 7.1

right angle, the image that was on A is now to be found on B). Thus at all times the image content on the other screen will correlate with and reflect that of the other.

Of course, we know that the two images do not refer to independently existent though interacting actualities (in which, for example, one image could be said to 'cause' related changes in the other). Rather, they refer to a single actuality, which is the common ground of both (and this explains the correlation of images without the assumption that they causally affect each other). This actuality is of higher dimensionality than are the separate images on the screens; or, to put it differently, the images on the screens are two-dimensional *projections* (or facets) of a three-dimensional reality. In some sense this three-dimensional reality holds these two-dimensional projections within it. Yet, since these projections exist only as abstractions, the three-dimensional reality *is* neither of these, but rather it is something else, something of a nature beyond both.

What we are proposing here is that the quantum property of a non-local, non-causal relationship of distant elements may be understood through an extension of the notion described above. That is to say, we may regard each of the 'particles' constituting a system as a projection of a 'higher-dimensional' reality, rather than as a separate particle, existing together with all the others in a common three-dimensional space. For example, in the experiment of Einstein, Podolsky and Rosen, which we have mentioned earlier, each of two atoms that initially combine to form a single molecule are to be regarded as three-dimensional projections of a six-dimensional reality. This may be demonstrated experimentally by causing the molecule to disintegrate and then observing the two atoms after they have separated and are quite distant from each other, so that they do not interact and therefore have no causal connections. What is actually found is that the behaviour of the two atoms is correlated in a way that is rather similar to that of the two television images of the fish, as

described earlier. Thus (as is, indeed, further shown by a more careful consideration of the mathematical form of the quantum laws involved here), each electron acts as if it were a projection of a higher-dimensional reality.

Under certain conditions,[8] the two three-dimensional projections corresponding to the two atoms may have a relative independence of behaviour. When these conditions are satisfied it will be a good approximation to treat both atoms as relatively independent but interacting particles, both in the same three-dimensional space. More generally, however, the two atoms will show the typical non-local correlation of behaviour which implies that, more deeply, they are only three-dimensional projections of the kind described above.

A system constituted of N 'particles' is then a $3N$-dimensional reality, of which each 'particle' is a three-dimensional projection. Under the ordinary conditions of our experience, these projections will be close enough to independence so that it will be a good approximation to treat them in the way that we usually do, as a set of separately existing particles all in the same three-dimensional space. Under other conditions this approximation will not be adequate. For example, at low temperatures an aggregate of electrons shows a new property of superconductivity, in which electrical resistance vanishes, so that electric current can flow indefinitely. This is explained by showing that the electrons enter a different kind of state, in which they are no longer relatively independent. Rather, each electron acts as a projection of a single higher-dimensional reality and all these projections share a non-local, non-causal correlation, which is such that they go round obstacles 'co-operatively' without being scattered or diffused, and therefore without resistance. (One could compare this behaviour to a ballet dance, while the usual behaviour of electrons could be compared to that of an agitated crowd of people, moving in a helter-skelter way.)

What follows from all this is that basically the implicate order

has to be considered as a process of enfoldment and unfoldment in a higher-dimensional space. Only under certain conditions can this be simplified as a process of enfoldment and unfoldment in three dimensions. Thus far, we have indeed used this sort of simplification, not only with the ink-in-fluid analogy but also with the hologram. Such a treatment, though, is only an approximation, even for the hologram. Indeed, as has already been pointed out earlier in this chapter, the electromagnetic field, which is the ground of the holographic image, obeys the laws of the quantum theory, and when these are properly applied to the field it is found that this, too, is actually a multidimensional reality which can only under certain conditions be simplified as a three-dimensional reality.

Quite generally, then, the implicate order has to be extended into a multidimensional reality. In principle this reality is one unbroken whole, including the entire universe with all its 'fields' and 'particles'. Thus we have to say that the holomovement enfolds and unfolds in a multidimensional order, the dimensionality of which is effectively infinite. However, as we have already seen, relatively independent sub-totalities can generally be abstracted, which may be approximated as autonomous. Thus the principle of relative autonomy of sub-totalities which we introduced earlier as basic to the holomovement is now seen to extend to the multidimensional order of reality.

5 COSMOLOGY AND THE IMPLICATE ORDER

From our consideration of how the general structure of matter can be understood in terms of the implicate order, we now come to certain new notions of cosmology that are implicit in what is being done here.

To bring these out, we first note that when the quantum theory is applied to fields (in the manner discussed in the previous section) it is found that the possible states of energy of this

field are discrete (or quantized). Such a state of the field is, in some respects, a wavelike excitation spreading out over a broad region of space. Nevertheless, it also has somehow a discrete quantum of energy (and momentum) proportional to its frequency, so that in other respects it is like a particle[9] (e.g., a photon). However, if one considers the electromagnetic field in empty space, for example, one finds from the quantum theory that each such 'wave-particle' mode of excitation of the field has what is called a 'zero-point' energy, below which it cannot go, even when its energy falls to the minimum that is possible. If one were to add up the energies of all the 'wave-particle' modes of excitation in any region of space, the result would be infinite, because an infinite number of wavelengths is present. However, there is good reason to suppose that one need not keep on adding the energies corresponding to shorter and shorter wavelengths. There may be a certain shortest possible wavelength, so that the total number of modes of excitation, and therefore the energy, would be finite.

Indeed, if one applies the rules of quantum theory to the currently accepted general theory of relativity, one finds that the gravitational field is also constituted of such 'wave-particle' modes, each having a minimum 'zero-point' energy. As a result the gravitational field, and therefore the definition of what is to be meant by distance, cease to be completely defined. As we keep on adding excitations corresponding to shorter and shorter wavelengths to the gravitational field, we come to a certain length at which the measurement of space and time becomes totally undefinable. Beyond this, the whole notion of space and time as we know it would fade out, into something that is at present unspecifiable. So it would be reasonable to suppose, at least provisionally, that this is the shortest wavelength that should be considered as contributing to the 'zero-point' energy of space.

When this length is estimated it turns out to be about 10^{-33} cm.

This is much shorter than anything thus far probed in physical experiments (which have got down to about 10^{-17} cm or so). If one computes the amount of energy that would be in one cubic centimetre of space, with this shortest possible wavelength, it turns out to be very far beyond the total energy of all the matter in the known universe.[10]

What is implied by this proposal is that what we call empty space contains an immense background of energy, and that matter as we know it is a small, 'quantized' wavelike excitation on top of this background, rather like a tiny ripple on a vast sea. In current physical theories, one avoids the explicit consideration of this background by calculating only the difference between the energy of empty space and that of space with matter in it. This difference is all that counts in the determination of the general properties of matter as they are presently accessible to observation. However, further developments in physics may make it possible to probe the above-described background in a more direct way. Moreover, even at present, this vast sea of energy may play a key part in the understanding of the cosmos as a whole.

In this connection it may be said that space, which has so much energy, is *full* rather than empty. The two opposing notions of space as empty and space as full have indeed continually alternated with each other in the development of philosophical and physical ideas. Thus, in Ancient Greece, the School of Parmenides and Zeno held that space is a plenum. This view was opposed by Democritus, who was perhaps the first seriously to propose a world view that conceived of space as emptiness (i.e., the void) in which material particles (e.g., atoms) are free to move. Modern science has generally favoured this latter atomistic view, and yet, during the nineteenth century, the former view was also seriously entertained, through the hypothesis of an *ether* that fills all space. Matter, thought of as consisting of special recurrent stable and separable forms in the ether (such as

ripples or vortices), would be transmitted through this plenum as if the latter were empty.

A similar notion is used in modern physics. According to the quantum theory, a crystal at absolute zero allows electrons to pass through it without scattering. They go through as if the space were empty. If the temperature is raised, inhomogeneities appear, and these scatter electrons. If one were to use such electrons to observe the crystal (i.e. by focusing them with an electron lens to make an image) what would be visible would be just the inhomogeneities. It would then appear that the inhomogeneities exist independently and that the main body of the crystal was sheer nothingness.

It is being suggested here, then, that what we perceive through the senses as empty space is actually the plenum, which is the ground for the existence of everything, including ourselves. The things that appear to our senses are derivative forms and their true meaning can be seen only when we consider the plenum, in which they are generated and sustained, and into which they must ultimately vanish.

This plenum is, however, no longer to be conceived through the idea of a simple material medium, such as an ether, which would be regarded as existing and moving only in a three-dimensional space. Rather, one is to begin with the holomovement, in which there is the immense 'sea' of energy described earlier. This sea is to be understood in terms of a multidimensional implicate order, along the lines sketched in section 4, while the entire universe of matter as we generally observe it is to be treated as a comparatively small pattern of excitation. This excitation pattern is relatively autonomous and gives rise to approximately recurrent, stable and separable projections into a three-dimensional explicate order of manifestation, which is more or less equivalent to that of space as we commonly experience it.

With all this in mind let us consider the current generally

accepted notion that the universe, as we know it, originated in what is almost a single point in space and time from a 'big bang' that happened some ten thousand million years ago. In our approach this 'big bang' is to be regarded as actually just a 'little ripple'. An interesting image is obtained by considering that in the middle of the actual ocean (i.e., on the surface of the Earth) myriads of small waves occasionally come together fortuitously with such phase relationships that they end up in a certain small region of space, suddenly to produce a very high wave which just appears as if from nowhere and out of nothing. Perhaps something like this could happen in the immense ocean of cosmic energy, creating a sudden wave pulse, from which our 'universe' would be born. This pulse would explode outward and break up into smaller ripples that spread yet further outward to constitute our 'expanding universe'. The latter would have its 'space' enfolded within it as a special distinguished explicate and manifest order.[11]

In terms of this proposal it follows that the current attempt to understand our 'universe' as if it were self-existent and independent of the sea of cosmic energy can work at best in some limited way (depending on how far the notion of a relatively independent sub-totality applies to it). For example, the 'black holes' may lead us into an area in which the cosmic background of energy is important. Also, of course, there may be many other such expanding universes.

Moreover, it must be remembered that even this vast sea of cosmic energy takes into account only what happens on a scale larger than the critical length of 10^{-33} cm, to which we have referred earlier. But this length is only a certain kind of limit on the applicability of ordinary notions of space and time. To suppose that there is nothing beyond this limit at all would indeed be quite arbitrary. Rather, it is very probable that beyond it lies a further domain, or set of domains, of the nature of which we have as yet little or no idea.

What we have seen thus far is a progression from explicate order to simple three-dimensional implicate order, then to a multidimensional implicate order, then to an extension of this to the immense 'sea' in what is sensed as empty space. The next stage may well lead to yet further enrichment and extension of the notion of implicate order, beyond the critical limit of 10^{-33} cm mentioned above; or it may lead to some basically new notions which could not be comprehended even within the possible further developments of the implicate order. Nevertheless, whatever may be possible in this regard, it is clear that we may assume that the principle of relative autonomy of sub-totalities continues to be valid. Any sub-totality, including those which we have thus far considered, may up to a point be studied in its own right. Thus, without assuming that we have already arrived even at an outline of absolute and final truth, we may at least for a time put aside the need to consider what may be beyond the immense energies of empty space, and go on to bring out the further implications of the sub-totality of order that has revealed itself thus far.

6 THE IMPLICATE ORDER, LIFE AND THE FORCE OF OVERALL NECESSITY

In this section we shall bring out the meaning of the implicate order by first showing how it makes possible the comprehension of both inanimate matter and life on the basis of a single ground, common to both, and then we shall go on to propose a certain more general form for the laws of the implicate order.

Let us begin by considering the growth of a living plant. This growth starts from a seed, but the seed contributes little or nothing to the actual material substance of the plant or to the energy needed to make it grow. This latter comes almost entirely from the soil, the water, the air and the sunlight. According to modern theories the seed contains *information*, in the form of DNA, and

this information somehow 'directs' the environment to form a corresponding plant.

In terms of the implicate order, we may say that even inanimate matter maintains itself in a continual process similar to the growth of plants. Thus, recalling the ink-in-fluid model of the electron, we see that such a 'particle' is to be understood as a recurrent stable order of unfoldment in which a certain form undergoing regular changes manifests again and again, but so rapidly that it appears to be in continuous existence. We may compare this to a forest, constituted of trees that are continually dying and being replaced by new ones. If it is considered on a long time-scale, this forest may be regarded likewise as a continuously existent but slowly-changing entity. So when understood through the implicate order, inanimate matter and living beings are seen to be, in certain key respects, basically similar to their modes of existence.

When inanimate matter is left to itself the above-described process of enfoldment and unfoldment just reproduces a similar form of inanimate matter, but when this is further 'informed' by the seed, it begins to produce a living plant instead. Ultimately, this latter gives rise to a new seed, which allows the process to continue after the death of this plant.

As the plant is formed, maintained and dissolved by the exchange of matter and energy with its environment, at which point can we say that there is a sharp distinction between what is alive and what is not? Clearly, a molecule of carbon dioxide that crosses a cell boundary into a leaf does not suddenly 'come alive' nor does a molecule of oxygen suddenly 'die' when it is released to the atmosphere. Rather, life itself has to be regarded as belonging in some sense to a totality, including plant and environment.

It may indeed be said that life is enfolded in the totality and that, even when it is not manifest, it is somehow 'implicit' in what we generally call a situation in which there is no life. We can illustrate this by considering the ensemble of all the atoms

that are now in the environment but that are eventually going to constitute a plant that will grow from a certain seed. This ensemble is evidently, in certain key ways, similar to that considered in section 3, of ink particles forming a droplet. In both cases the elements of the ensemble are bound together to contribute to a common end (in one case an ink droplet and in the other case a living plant).

The above does not mean, however, that life can be reduced completely to nothing more than that which comes out of the activity of a basis governed by the laws of inanimate matter alone (though we do not deny that *certain* features of life may be understood in this way). Rather, we are proposing that as the notion of the holomovement was enriched by going from three-dimensional to multidimensional implicate order and then to the vast 'sea' of energy in 'empty' space, so we may now enrich this notion further by saying that in its totality the holomovement includes the principle of life as well. Inanimate matter is then to be regarded as a relatively autonomous sub-totality in which, at least as far as we now know, life does not significantly manifest. That is to say, inanimate matter is a secondary, derivative, and particular abstraction from the holomovement (as would also be the notion of a 'life force' entirely independent of matter). Indeed, the holomovement which is 'life implicit' is the ground both of 'life explicit' and of 'inanimate matter', and this ground is what is primary, self-existent and universal. Thus we do not fragment life and inanimate matter, nor do we try to reduce the former completely to nothing but an outcome of the latter.

Let us now put the above approach in a more general way. What is basic to the law of the holomovement is, as we have seen, the possibility of abstraction of a set of relatively autonomous sub-totalities. We can now add that the laws of each such abstracted sub-totality quite generally operate under certain conditions and limitations defined only in a corresponding total

situation (or set of similar situations). This operation will in general have these three key features:

1 A set of implicate orders.
2 A special distinguished case of the above set, which constitutes an explicate order of manifestation.
3 A general relationship (or law) expressing a force of necessity which binds together a certain set of the elements of the implicate order in such a way that they contribute to a common explicate end (different from that to which another set of inter-penetrating and intermingling elements will contribute).

The origin of this force of necessity cannot be understood solely in terms of the explicate and implicate orders belonging to the type of situation in question. Rather, at this level, such necessity has simply to be accepted as inherent in the overall situation under discussion. An understanding of its origin would take us to a deeper, more comprehensive and more inward level of relative autonomy which, however, would also have its implicate and explicate orders and a correspondingly deeper and more inward force of necessity that would bring about their transformation into each other.[12]

In short, we are proposing that this *form* of the law of a relatively autonomous sub-totality, which is a consistent generalization of all the forms that we have studied thus far, is to be considered as universal; and that in our subsequent work we shall explore the implicates of such a notion, at least tentatively and provisionally.

7 CONSCIOUSNESS AND THE IMPLICATE ORDER

At this point it may be said that at least some outlines of our notions of cosmology and of the general nature of reality have

been sketched (though, of course, to 'fill in' this sketch with adequate detail would require a great deal of further work much of which still remains to be done). Let us now consider how consciousness may be understood in relation to these notions.

We begin by proposing that in some sense, consciousness (which we take to include thought, feeling, desire, will, etc.) is to be comprehended in terms of the implicate order, along with reality as a whole. That is to say, we are suggesting that the implicate order applies both to matter (living and non-living) and to consciousness, and that it can therefore make possible an understanding of the general relationship of these two, from which we may be able to come to some notion of a common ground of both (rather as was also suggested in the previous section in our discussion of the relationship of inanimate matter and life).

To obtain an understanding of the relationship of matter and consciousness has, however, thus far proved to be extremely difficult, and this difficulty has its root in the very great difference in their basic qualities as they present themselves in our experience. This difference has been expressed with particularly great clarity by Descartes, who described matter as 'extended substance' and consciousness as 'thinking substance'. Evidently, by 'extended substance' Descartes meant something made up of distinct forms existing in space, in an order of extension and separation basically similar to the one that we have been calling explicate. By using the term 'thinking substance' in such sharp contrast to 'extended substance' he was clearly implying that the various distinct forms appearing in thought do not have their existence in such an order of extension and separation (i.e., some kind of space), but rather in a different order, in which extension and separations have no fundamental significance. The implicate order has just this latter quality, so in a certain sense Descartes was perhaps anticipating that consciousness has to be

understood in terms of an order that is closer to the implicate than it is to the explicate.

However, when we start, as Descartes did, with extension and separation in space as primary for matter, then we can see nothing in this notion that can serve as a basis for a relationship between matter and consciousness, whose orders are so different. Descartes clearly understood this difficulty and indeed proposed to resolve it by means of the idea that such a relationship is made possible by God, who being outside of and beyond matter and consciousness (both of which He has indeed created) is able to give the latter 'clear and distinct notions' that are currently applicable to the former. Since then, the idea that God takes care of this requirement has generally been abandoned, but it has not commonly been noticed that thereby the possibility of comprehending the relationship between matter and consciousness has collapsed.

In this chapter, we have, however, shown in some detail that matter as a whole can be understood in terms of the notion that the implicate order is the immediate and primary actuality (while the explicate order can be derived as a particular, distinguished case of the implicate order). The question that arises here, then, is that of whether or not (as was in a certain sense anticipated by Descartes) the actual 'substance' of consciousness can be understood in terms of the notion that the implicate order is also its primary and immediate actuality. If matter and consciousness could in this way be understood together, in terms of the same general notion of order, the way would be opened to comprehending their relationship on the basis of some common ground.[13] Thus we could come to the germ of a new notion of unbroken wholeness, in which consciousness is no longer to be fundamentally separated from matter.

Let us now consider what justification there is for the notion that matter and consciousness have the implicate order in common. First, we note that matter in general is, in the first instance,

the object of our consciousness. However, as we have seen throughout this chapter, various energies such as light, sound, etc., are continually enfolding information in principle concerning the entire universe of matter into each region of space. Through this process, such information may of course enter our sense organs, to go on through the nervous system to the brain. More deeply, all the matter in our bodies, from the very first, enfolds the universe in some way. Is this enfolded structure, both of information and of matter (e.g., in the brain and nervous system), that which primarily enters consciousness?

Let us first consider the question of whether information is actually enfolded in the brain cells. Some light on this question is afforded by certain work on brain structure, notably that of Pribram.[14] Pribram has given evidence backing up his suggestion that memories are generally recorded all over the brain in such a way that information concerning a given object or quality is not stored in a particular cell or localized part of the brain but rather that all the information is enfolded over the whole. This storage resembles a hologram in its function, but its actual structure is much more complex. We can then suggest that when the 'holographic' record in the brain is suitably activated, the response is to create a pattern of nervous energy constituting a partial experience similar to that which produced the 'hologram' in the first place. But it is also different in that it is less detailed, in that memories from many different times may merge together, and in that memories may be connected by association and by logical thought to give a certain further order to the whole pattern. In addition, if sensory data is also being attended to at the same time, the whole of this response from memory will, in general, fuse with the nervous excitation coming from the senses to give rise to an overall experience in which memory, logic, and sensory activity combine into a single unanalysable whole.

Of course, consciousness is more than what has been described above. It also involves awareness, attention, perception,

acts of understanding, and perhaps yet more. We have suggested in the first chapter that these must go beyond a mechanistic response (such as that which the holographic model of brain function would by itself imply). So in studying them we may be coming closer to the essence of actual conscious experience than is possible merely by discussing patterns of excitation of the sensory nerves and how they may be recorded in memory.

It is difficult to say much about faculties as subtle as these. However, by reflecting on and giving careful attention to what happens in certain experiences, one can obtain valuable clues. Consider, for example, what takes place when one is listening to music. At a given moment a certain note is being played but a number of the previous notes are still 'reverberating' in consciousness. Close attention will show that it is the simultaneous presence and activity of all these reverberations that is responsible for the direct and immediately felt sense of movement, flow and continuity. To hear a set of notes so far apart in time that there is no such reverberation will destroy altogether the sense of a whole unbroken, living movement that gives meaning and force to what is heard.

It is clear from the above that one does not experience the actuality of this whole movement by 'holding on' to the past, with the aid of a memory of the sequence of notes, and comparing this past with the present. Rather, as one can discover by further attention, the 'reverberations' that make such an experience possible are not memories but are rather *active transformations* of what came earlier, in which are to be found not only a generally diffused sense of the original sounds, with an intensity that falls off, according to the time elapsed since they were picked up by the ear, but also various emotional responses, bodily sensations, incipient muscular movements, and the evocation of a wide range of yet further meanings, often of great subtlety. One can thus obtain a direct sense of how a sequence of notes is enfolding into many levels of consciousness, and of how at any

given moment, the transformations flowing out of many such enfolded notes inter-penetrate and intermingle to give rise to an immediate and primary feeling of movement.

This activity in consciousness evidently constitutes a striking parallel to the activity that we have proposed for the implicate order in general. Thus in section 3, we have given a model of an electron in which, at any instant, there is a co-present set of differently transformed ensembles which inter-penetrate and intermingle in their various degrees of enfoldment. In such enfoldment, there is a radical change, not only of form but also of structure, in the entire set of ensembles (which change we have, in chapter 6, called a metamorphosis); and yet, a certain totality of order in the ensembles remains invariant, in the sense that in all these changes a subtle but fundamental similarity of order is preserved.[15]

In the music, there is, as we have seen, a basically similar transformation (of notes) in which a certain order can also be seen to be preserved. The key difference in these two cases is that for our model of the electron an enfolded order is grasped *in thought*, as the presence together of many different but inter-related degrees of transformations of ensembles, while for the music, it is *sensed immediately* as the presence together of many different but interrelated degrees of transformations of tones and sounds. In the latter, there is a feeling of both tension and harmony between the various co-present transformations, and this feeling is indeed what is primary in the apprehension of the music in its undivided state of flowing movement.

In listening to music, *one is therefore directly perceiving an implicate order*. Evidently this order is *active* in the sense that it continually flows into emotional, physical, and other responses, that are inseparable from the transformations out of which it is essentially constituted.

A similar notion can be seen to be applicable for vision. To bring this out, consider the sense of motion that arises when one

is watching the cinema screen. What is actually happening is that a series of images, each slightly different, is being flashed on the screen. If the images are separated by long intervals of time, one does not get a feeling of continuous motion, but rather, one sees a series of disconnected images perhaps accompanied by a sense of jerkiness. If, however, the images are close enough together (say a hundredth of a second) one has a direct and immediate experience, as if from a continuously moving and flowing reality, undivided and without a break.

This point can be brought out even more clearly by considering a well-known illusion of movement, produced with the aid of a stroboscopic device, illustrated in Figure 7.2.

Two discs, A and B, enclosed in a bulb, can be caused to give off light by means of electrical excitation. The light is made to flash on and off so rapidly that it appears to be continuous, but in each flash it is arranged that B will come on slightly later than A. What one actually feels is a sense of 'flowing movement' between A and B, but that paradoxically nothing is flowing out of B (contrary to what would be expected if there had been a real process of flow). This means that a sense of flowing movement is experienced when, on the retina of the eye, there are two images in neighbouring positions one of which comes on slightly later than the other. (Closely related to this is the fact that a blurred photograph of a speeding car, containing a sequence of overlaid images in slightly different positions, conveys to us a much more immediate and vivid sense of

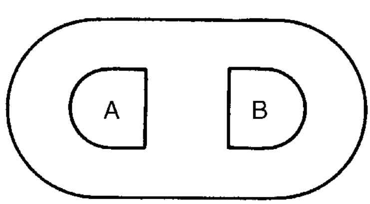

Figure 7.2

movement than does a sharp picture, taken with a high-speed camera.)

It seems evident that the sense of unbroken movement described above is basically similar to that arising from a sequence of musical notes. The main difference between music and visual images, in this regard, is that the latter may arrive so close together in time that they cannot be resolved in consciousness. Nevertheless, it is clear that visual images must also undergo active transformation as they 'enfold' into the brain and nervous system (e.g., they give rise to emotional, physical and other more subtle responses of which one may be only dimly conscious as well as to 'after images' that are in certain ways similar to the reverberations in musical notes). Even though the time difference of two such images may be small, the examples cited above make it clear that a sense of movement is experienced through the intermingling and inter-penetration of the co-present transformations to which these images must give rise as they penetrate the brain and nervous system.

All of this suggests that quite generally (and not merely for the special case of listening to music), there is a basic similarity between the order of our immediate experience of movement and the implicate order as expressed in terms of our thought. We have in this way been brought to the possibility of a coherent mode of understanding the immediate experience of motion in terms of our thought (in effect thus resolving Zeno's paradox concerning motion).

To see how this comes about, consider how motion is usually thought of, in terms of a series of points along a line. Let us suppose that at a certain time t_1, a particle is at a position x_1, while at a later time t_2, it is at another position x_2. We then say that this particle is moving and that its velocity is

$$v = \frac{x_2 - x_1}{t_2 - t_1}.$$

Of course, this way of thinking does not in any way reflect or convey the immediate sense of motion that we may have at a given moment, for example, with a sequence of musical notes reverberating in consciousness (or in the visual perception of a speeding car). Rather, it is only an abstract symbolization of movement, having a relation to the actuality of motion, similar to that between a musical score and the actual experience of the music itself.

If, as is commonly done, we take the above abstract symbolization as a faithful representation of the actuality of movement we become entangled in a series of confused and basically insoluble problems. These all have to do with the image in which we represent time, as if it were a series of points along a line that are somehow all present together, either to our conceptual gaze or perhaps to that of God. Our actual experience is, however, that when a given moment, say t_2, is present and actual, an earlier moment, such as t_1, is past. That is to say, it is *gone*, non-existent, never to return. So if we say that the velocity of a particular *now* (at t_2) is $(x_2 - x_1)/(t_2 - t_1)$ we are trying to relate *what is* (i.e., x_2 and t_2) to *what is not* (i.e., x_1 and t_1). We can of course do this *abstractly and symbolically* (as is, indeed, the common practice in science and mathematics), but the further fact, not comprehended in this abstract symbolism, is that the velocity *now* is active *now* (e.g., it determines how a particle will act from now on, in itself, and in relation to other particles). How are we to understand the *present* activity of a position (x_1) that is now non-existent and gone for ever?

It is commonly thought that this problem is resolved by the differential calculus. What is done here is to let the time interval, $\Delta t = t_2 - t_1$ become vanishingly small, along with $\Delta x = x_2 - x_1$. The velocity *now* is defined as the limit of the ratio $\Delta x/\Delta t$ as Δt approaches zero. It is then implied that the problem described above no longer arises, because x_2 and x_1 are in effect taken at the

same time. They may thus be present together and related in an activity that depends on both.

A little reflection shows, however, that this procedure is still as abstract and symbolic as was the original one in which the time interval was taken as finite. Thus one has no immediate experience of a time interval of zero length, nor can one see in terms of reflective thought what this could mean.

Even as an abstract formalism, this approach is not fully consistent in a logical sense, nor does it have a universal range of applicability. Indeed, it applies only within the area of *continuous* movements and then only as a technical algorithm that happens to be correct for this sort of movement. As we have seen, however, according to the quantum theory, movement is *not* fundamentally continuous. So even as an algorithm its current field of application is limited to theories expressed in terms of classical concepts (i.e., in the explicate order) in which it provides a good approximation for the purpose of calculating the movements of material objects.

When we think of movement in terms of the implicate order,[16] however, these problems do not arise. In this order, movement is comprehended in terms of a series of interpenetrating and intermingling elements in different degrees of enfoldment *all present together*. The activity of this movement then presents no difficulty, because it is an outcome of this whole enfolded order, and is determined by relationships of co-present elements, rather than by the relationships of elements that exist to others that no longer exist.

We see, then, that through thinking in terms of the implicate order, we come to a notion of movement that is logically coherent and that properly represents our immediate experience of movement. Thus the sharp break between abstract logical thought and concrete immediate experience, that has pervaded our culture for so long, need no longer be maintained. Rather, the possibility is created for an unbroken flowing movement

from immediate experience to logical thought and back, and thus for an ending to this kind of fragmentation.

Moreover we are now able to understand in a new and more consistent way our proposed notion concerning the general nature of reality, that *what is* is movement. Actually, what tends to make it difficult for us to work in terms of this notion is that we usually think of movement in the traditional way as an active relationship of what is to what is not. Our traditional notion concerning the general nature of reality would then amount to saying that *what is* is an active relationship of what is to what is not. To say this is, at the very least, confused. In terms of the implicate order, however, movement is a relationship of certain phases of *what is* to other phases of *what is*, that are in different stages of enfoldment. This notion implies that the essence of reality as a whole is the above relationship among the various phases in different stages of enfoldment (rather than, for example, a relationship between various particles and fields that are all explicate and manifest).

Of course, actual movement involves more than the mere immediate intuitive sense of unbroken flow, which is our mode of directly experiencing the implicate order. The presence of such a sense of flow generally implies further that, in the next moment, the state of affairs will actually change – i.e., it will be different. How are we to understand this fact of experience in terms of the implicate order?

A valuable clue is provided by reflecting on and giving careful attention to what happens when, in our thinking, we say that one set of ideas *implies* an entirely different set. Of course, the word ‘imply’ has the same root as the word ‘implicate’ and thus also involves the notion of enfoldment. Indeed, by saying that something is *implicit* we generally mean more than merely to say that this thing is an inference following from something else through the rules of logic. Rather, we usually mean that from many different ideas and notions (of some of which we are

explicitly conscious) a new notion emerges that somehow brings all these together in a concrete and undivided whole.

We see, then, that each moment of consciousness has a certain *explicit* content, which is a foreground, and an *implicit* content, which is a corresponding background. We now propose that not only is immediate experience best understood in terms of the implicate order, but that thought also is basically to be comprehended in this order. Here we mean not just the *content* of thought for which we have already begun to use the implicate order. Rather, we also mean that the actual *structure, function* and *activity* of thought is in the implicate order. The distinction between implicit and explicit in thought is thus being taken here to be essentially equivalent to the distinction between implicate and explicate in matter in general.

To help clarify what this means, let us recall briefly the basic form of the law of a sub-totality (discussed in sections 3 and 6), i.e., that the enfolded elements of a characteristic ensemble (e.g., of ink particles or of atoms) that are going to constitute the next stage of enfoldment are bound by a force of overall necessity, which brings them together, to contribute to a common end that emerges in the next phase of the process under discussion. Similarly, we propose that the ensemble of elements enfolded in the brain and nervous system that are going to constitute the next stage of development of a line of thought are likewise bound through a force of overall necessity, which brings them together to contribute to the common notion that emerges in the next moment of consciousness.

In this study, we have been using the idea that consciousness can be described in terms of a series of moments. Attention shows that a given moment cannot be fixed exactly in relation to time (e.g., by the clock) but rather, that it covers some vaguely defined and somewhat variable extended period of duration. As pointed out earlier, each moment is experienced directly in the implicate order. We have further seen that through the force of

necessity in the overall situation, one moment gives rise to the next, in which content that was previously implicate is now explicate while the previous explicate content has become implicate (e.g., as happened in the analogy of the ink droplets).

The continuation of the above process gives an account of how *change* takes place from one moment to another. In principle, the change in any moment may be a fundamental and radical transformation. However, experience shows that in thought (as in matter in general) there is usually a great deal of recurrence and stability leading to the possibility of relatively independent sub-totalities.

In any such sub-totality, there is the possibility of the continuation of a certain line of thought that enfolds in a fairly regularly changing way. Evidently, the precise character of such a sequence of thoughts, as it enfolds from one moment to the next, will generally depend on the content of the implicate order in earlier moments. For example, a moment containing a sense of movement tends quite generally to be followed by a change in the next moment which is greater the stronger the sense of movement that was originally present (so that, as in the case of the stroboscopic device discussed earlier, when this does not happen we feel that something surprising or paradoxical is taking place).

As in our discussion of matter in general, it is now necessary to go into the question of how in consciousness the explicate order is what is manifest. As observation and attention show (keeping in mind that the word 'manifest' means that which is recurrent, stable and separable) the manifest content of consciousness is based essentially on memory, which is what allows such content to be held in a fairly constant form. Of course, to make possible such constancy it is also necessary that this content be organized, not only through relatively fixed associations but also with the aid of the rules of logic, and of our basic categories of space, time, causality, universality, etc. In this way

an overall system of concepts and mental images may be developed, which is a more or less faithful representation of the 'manifest world'.

The process of thought is not, however, merely a *representation* of the manifest world; rather, it makes an important *contribution* to how we experience this world, for, as we have already pointed out earlier, this experience is a fusion of sensory information with the 'replay' of some of the content of memory (which latter contains thought built into its very form and order). In such experience, there will be a strong background of recurrent, stable, and separable features, against which the transitory and changing aspects of the unbroken flow of experience will be seen as fleeting impressions that tend to be arranged and ordered mainly in terms of the vast totality of the relatively static and fragmented content of recordings from the past.

One can, in fact, adduce a considerable amount of scientific evidence showing how much of our conscious experience is a construction based on memory organized through thought, in the general way described above.[17] To go into this subject in detail would, however, carry us too far afield. It may nevertheless be useful here to mention that Piaget[18] has made it clear that a consciousness of what to us is the familiar order of space, time, causality, etc. (which is essentially what we have been calling the explicate order) operates only to a small extent in the earliest phases of life of the human individual. Rather, as he shows from careful observations, for the most part infants *learn* this content first in the area of sensori-motor experience, and later as they grow older they connect such experience with its expression in language and logic. On the other hand, there seems to be an immediate awareness of movement from the very earliest. Recalling that movement is sensed primarily in the implicate order, we see that Piaget's work supports the notion that the experiencing of the implicate order is fundamentally much more immediate and direct than is that of the explicate order,

which, as we have pointed out above, requires a complex construction that has to be learned.

One reason why we do not generally notice the primacy of the implicate order is that we have become so habituated to the explicate order, and have emphasized it so much in our thought and language, that we tend strongly to feel that our primary experience is of that which is explicate and manifest. However, another reason, perhaps more important, is that the activation of memory recordings whose content is mainly that which is recurrent, stable, and separable, must evidently focus our attention very strongly on what is static and fragmented.

This then contributes to the formation of an experience in which these static and fragmented features are often so intense that the more transitory and subtle features of the unbroken flow (e.g., the 'transformations' of musical notes) generally tend to pale into such seeming insignificance that one is, at best, only dimly conscious of them. Thus, an illusion may arise in which the manifest static and fragmented content of consciousness is experienced as the very basis of reality and from this illusion one may apparently obtain a proof of the correctness of that mode of thought in which this content is taken to be fundamental.[19]

8 MATTER, CONSCIOUSNESS AND THEIR COMMON GROUND

At the beginning of the previous section we suggested that matter and consciousness can both be understood in terms of the implicate order. We shall now show how the notions of implicate order that we have developed in connection with consciousness may be related to those concerning matter, to make possible an understanding of how both may have a common ground.

We begin by noting that (as pointed out in chapters 1 and 5) current relativistic theories in physics describe the whole of

reality in terms of a process whose ultimate element is a point event, i.e., something happening in a relatively small region of space and time. We propose instead that the basic element be a *moment* which, like the moment of consciousness, cannot be precisely related to measurements of space and time, but rather covers a somewhat vaguely defined region which is extended in space and has duration in time. The extent and duration of a moment may vary from something very small to something very large, according to the context under discussion (even a particular century may be a 'moment' in the history of mankind). As with consciousness, each moment has a certain explicate order, and in addition it enfolds all the others, though in its own way. So the relationship of each moment in the whole to all the others is implied by its total content: the way in which it 'holds' all the others enfolded within it.

In certain ways this notion is similar to Leibniz's idea of monads, each of which 'mirrors' the whole in its own way, some in great detail and others rather vaguely. The difference is that Leibniz's monads had a permanent existence, whereas our basic elements are only moments and are thus not permanent. Whitehead's idea of 'actual occasions' is closer to the one proposed here, the main difference being that we use the implicate order to express the qualities and relationships of our moments, whereas Whitehead does this in a rather different way.

We now recall that the laws of the implicate order are such that there is a relatively independent, recurrent, stable subtotality which constitutes the explicate order, and which, of course, is basically the order that we commonly contact in common experience (extended in certain ways by our scientific instruments). This order has room in it for something like memory, in the sense that previous moments generally leave a trace (usually enfolded) that continues in later moments, though this trace may change and transform almost without limit. From this trace (e.g., in the rocks) it is in principle possible for us to

unfold an image of past moments, similar in certain ways, to what actually happened; and by taking advantage of such traces, we design instruments such as photographic cameras, tape recorders, and computer memories, which are able to register actual moments in such a way that much more of the content of what has happened can be made directly and immediately accessible to us than is generally possible from natural traces alone.

One may indeed say that our memory is a special case of the process described above, for all that is recorded is held enfolded within the brain cells and these are part of matter in general. The recurrence and stability of our own memory as a relatively independent sub-totality is thus brought about as part of the very same process that sustains the recurrence and stability in the manifest order of matter in general.

It follows, then, that the explicate and manifest order of consciousness is not ultimately distinct from that of matter in general. Fundamentally these are essentially different aspects of the one overall order. This explains a basic fact that we have pointed out earlier – that the explicate order of matter in general is also in essence the sensuous explicate order that is presented in consciousness in ordinary experience.

Not only in this respect but, as we have seen, also in a wide range of other important respects, consciousness and matter in general are basically the same order (i.e., the implicate order as a whole). As we have indicated earlier this order is what makes a relationship between the two possible; but more specifically, what are we to say about the nature of this relationship?

We may begin by considering the individual human being as a relatively independent sub-totality, with a sufficient recurrence and stability of his total process (e.g., physical, chemical, neurological, mental, etc.) to enable him to subsist over a certain period of time. In this process we know it to be a fact that the physical state can affect the content of consciousness in many

ways. (The simplest case is that we can become conscious of neural excitations as sensations.) Vice versa, we know that the content of consciousness can affect the physical state (e.g., from a conscious intention nerves may be excited, muscles may move, the heart-beat change, along with alterations of glandular activity, blood chemistry, etc.).

This connection of the mind and body has commonly been called psychosomatic (from the Greek 'psyche', meaning 'mind' and 'soma', meaning 'body'). This word is generally used, however, in such a way as to imply that mind and body are separately existent but connected by some sort of interaction. Such a meaning is not compatible with the implicate order. In the implicate order we have to say that mind enfolds matter in general and therefore the body in particular. Similarly, the body enfolds not only the mind but also in some sense the entire material universe. (In the manner explained earlier in this section, both through the senses and through the fact that the constituent atoms of the body are actually structures that are enfolded in principle throughout all space.)

This kind of relationship has in fact already been encountered in section 4, where we introduced the notion of a higher-dimensional reality which *projects* into lower-dimensional elements that have not only a non-local and non-causal relationship but also just the sort of mutual enfoldment that we have suggested for mind and body. So we are led to propose further that the more comprehensive, deeper, and more inward actuality is neither mind nor body but rather a yet higher-dimensional actuality, which is their common ground and which is of a nature beyond both. Each of these is then only a relatively independent sub-totality and it is implied that this relative independence derives from the higher-dimensional ground in which mind and body are ultimately one (rather as we find that the relative independence of the manifest order derives from the ground of the implicate order).

In this higher-dimensional ground the implicate order prevails. Thus, within this ground, *what is* is movement which is represented in thought as the co-presence of many phases of the implicate order. As happens with the simpler forms of the implicate order considered earlier, the state of movement at one moment unfolds through a more inward force of necessity inherent in this overall state of affairs, to give rise to a new state of affairs in the next moment. The projections of the higher-dimensional ground, as mind and body, will in the later moment both be different from what they were in the earlier moment, though these differences will of course be related. So we do not say that mind and body causally affect each other, but rather that the movements of both are the outcome of related projections of a common higher-dimensional ground.

Of course, even this ground of mind and body is limited. At the very least we have evidently to include matter beyond the body if we are to give an adequate account of what actually happens and this must eventually include other people, going on to society and to mankind as a whole. In doing this, however, we will have to be careful not to slip back into regarding the various elements of any given total situation as having anything more than relative independence. In a deeper and generally more suitable way of thinking, each of these elements is a projection, in a sub-totality of yet higher 'dimension'. So it will be ultimately misleading and indeed wrong to suppose, for example, that each human being is an independent actuality who interacts with other human beings and with nature. Rather, all these are projections of a single totality. As a human being takes part in the process of this totality, he is fundamentally changed in the very activity in which his aim is to change that reality which is the content of his consciousness. To fail to take this into account must inevitably lead one to serious and sustained confusion in all that one does.

From the side of mind we can also see that it is necessary to go

on to a more inclusive ground. Thus, as we have seen, the easily accessible explicit content of consciousness is included within a much greater implicit (or implicate) background. This in turn evidently has to be contained in a yet greater background which may include not only neuro-physiological processes at levels of which we are not generally conscious but also a yet greater background of unknown (and indeed ultimately unknowable) depths of inwardness that may be analogous to the 'sea' of energy that fills the sensibly perceived 'empty' space.[20]

Whatever may be the nature of these inward depths of consciousness, they are the very ground, both of the explicit content and of that content which is usually called implicit. Although this ground may not appear in ordinary consciousness, it may nevertheless be present in a certain way. Just as the vast 'sea' of energy in space is present to our perception as a *sense* of emptiness or nothingness so the vast 'unconscious' background of explicit consciousness with all its implications is present in a similar way. That is to say, it may be *sensed* as an emptiness, a nothingness, within which the usual content of consciousness is only a vanishingly small set of facets.

Let us now consider briefly what may be said about time in this total order of matter and consciousness.

First, it is well known that, as directly sensed and experienced in consciousness, time is highly variable and relative to conditions (e.g., a given period may be felt to be short or long by different people, or even by the same person, according to the interests of the different people concerned). On the other hand it seems in common experience that physical time is absolute and does not depend on conditions. However, one of the most important implications of the theory of relativity is that physical time is in fact relative, in the sense that it may vary according to the speed of the observer. (This variation is, however, significant only as we approach the speed of light and is quite negligible in the domain of ordinary experience.) What is crucial in the

present context is that, according to the theory of relativity, a sharp distinction between space and time can not be maintained (except as an approximation, valid at velocities small compared with that of light). Thus, since the quantum theory implies that elements that are separated in space are generally non-causally and non-locally related projections of a higher-dimensional reality, it follows that moments separated in time are also such projections of this reality.

Evidently, this leads to a fundamentally new notion of the meaning of time. Both in common experience and in physics, time has generally been considered to be a primary, independent and universally applicable order, perhaps the most fundamental one known to us. Now, we have been led to propose that it is secondary and that, like space (see section 5), it is to be derived from a higher-dimensional ground, as a particular order. Indeed, one can further say that many such particular interrelated time orders can be derived for different sets of sequences of moments, corresponding to material systems that travel at different speeds. However, these are all dependent on a multidimensional reality that cannot be comprehended fully in terms of any time order, or set of such orders.

Similarly, we are led to propose that this multidimensional reality may project into many orders of sequences of moments in consciousness. Not only do we have in mind here the relativity of psychological time discussed above, but also much more subtle implications. Thus, for example, people who know each other well may separate for a long time (as measured by the sequence of moments registered by a clock) and yet they are often able to 'take up from where they left off' as if no time had passed. What we are proposing here is that sequences of moments that 'skip' intervening spaces are just as allowable forms of time as those which seem continuous.[21]

The fundamental law, then, is that of the immense multidimensional ground; and the projections from this ground

determine whatever time orders there may be. Of course, this law may be such that in certain limiting cases the order of moments corresponds approximately to what would be determined by a simple causal law. Or, in a different limiting case, the order would be a complex one of a high degree which would, as indicated in chapter 5, approximate what is usually called a random order. These two alternatives cover what happens for the most part in the domain of ordinary experience as well as in that of classical physics. Nevertheless, in the quantum domain as well as in connection with consciousness and probably with the understanding of the deeper more inward essence of life, such approximations will prove to be inadequate. One must then go on to a consideration of time as a projection of multidimensional reality into a sequence of moments.

Such a projection can be described as creative, rather than mechanical, for by creativity one means just the inception of new content, which unfolds into a sequence of moments that is not completely derivable from what came earlier in this sequence or set of such sequences. What we are saying is, then, that movement is basically such a creative inception of new content as projected from the multidimensional ground. In contrast, what is mechanical is a relatively autonomous sub-totality that can be abstracted from that which is basically a creative movement of unfoldment.

How, then, are we to consider the evolution of life as this is generally formulated in biology? First, it has to be pointed out that the very word 'evolution' (whose literal meaning is 'unrolling') is too mechanistic in its connotation to serve properly in this context. Rather, as we have already pointed out above, we should say that various successive living forms unfold creatively. Later members are not completely derivable from what came earlier, through a process in which effect arises out of cause (though in some approximation such a causal process may explain certain limited aspects of the sequence). The law of this

unfoldment cannot be properly understood without considering the immense multidimensional reality of which it is a projection (except in the rough approximation in which the implications of the quantum theory and of what is beyond this theory may be neglected).

Our overall approach has thus brought together questions of the nature of the cosmos, of matter in general, of life, and of consciousness. All of these have been considered to be projections of a common ground. This we may call the ground of all that is, at least in so far as this may be sensed and known by us, in our present phase of unfoldment of consciouness. Although we have no detailed perception or knowledge of this ground it is still in a certain sense enfolded in our consciousness, in the ways in which we have outlined, as well as perhaps in other ways that are yet to be discovered.

Is this ground the absolute end of everything? In our proposed views concerning the general nature of 'the totality of all that is' we regard even this ground as a mere stage, in the sense that there could in principle be an infinity of further development beyond it. At any particular moment in this development each such set of views that may arise will constitute at most a *proposal*. It is not to be taken as an *assumption* about what the final truth is supposed to be, and still less as a *conclusion* concerning the nature of such truth. Rather, this proposal becomes itself an *active factor* in the totality of existence which includes ourselves as well as the objects of our thoughts and experimental investigations. Any further proposals on this process will, like those already made, have to be *viable*. That is to say, one will require of them a general self-consistency as well as consistency in what flows from them in life as a whole. Through the force of an even deeper, more inward necessity in this totality, some new state of affairs may emerge in which both the world as we know it and our ideas about it may undergo an unending process of yet further change.

With this we have in essence carried the presentation of our cosmology and our general notions concerning the nature of the totality to a natural (though of course only a temporary) stopping point. From here on we can further survey it as a whole and perhaps fill in some of the details that have been left out in this necessarily sketchy treatment before going on to new developments of the kinds indicated above.

Notes

1 FRAGMENTATION AND WHOLENESS

1 See, for example, J. Krishnamurti, *Freedom from the Known*, Gollancz, London, 1969.

2 THE RHEOMODE – AN EXPERIMENT WITH LANGUAGE AND THOUGHT

1 Actually, the Latin root 'videre' in 'divide' does not mean 'to see' but 'to set apart'. This appears to have come about in a coincidental manner. However, the purposes of the rheomode are served much better by taking advantage of this coincidence, and by regarding division as primarily an act of perception rather than a physical act of separation.

2 Whenever a word is obtained from a form with a prefix, such as di-, co-, con-, etc., in the root verb of the rheomode, this prefix will be separated from the main verb by a hyphen, in order to indicate how the verb has been constructed in this way.

3 Note that, from now on, in the interests of brevity we will generally not give as full a description of the meaning of the root form as we have been doing thus far.

3 REALITY AND KNOWLEDGE CONSIDERED AS PROCESS

1 A. N. Whitehead, *Process and Reality*, Macmillan, New York, 1933.
2 H. C. Wyld, *The Universal Dictionary of the English Language*, Routledge & Kegan Paul, London, 1960.
3 J. Piaget, *The Origin of Intelligence in the Child*, Routledge & Kegan Paul, London, 1953.

4 HIDDEN VARIABLES IN THE QUANTUM THEORY

1 D. Bohm, *Causality and Chance in Modern Physics*, Routledge & Kegan Paul, London, 1957.
2 See J. von Neumann, *Mathematical Foundations of the Quantum Theory*, Princeton University Press, 1955; W. Heisenberg, *The Physical Principles of the Quantum Theory*, University of Chicago Press, 1930; P. Dirac, *The Principles of Quantum Mechanics*, Oxford University Press, 1947; P. A. Schilp (ed.), *Albert Einstein, Philosopher Scientist*, Tudor Press, New York, 1957, especially ch. 7 for a discussion of Bohr's point of view.
3 *Ibid.*
4 von Neumann, *op. cit.*
5 A. Einstein, N. Rosen and B. Podolsky, *Phys. Rev.*, vol. 47, 1935, p. 777.
6 D. Bohm, *Quantum Theory*, Prentice-Hall, New York, 1951.
7 For a discussion of Bohr's point of view see Schilp, *op. cit.*, ch. 7.
8 D. Bohm, *Phys. Rev.*, vol. 85, 1952, pp. 166, 180.
9 L. de Broglie, *Compt. rend.*, vol. 183, 1926, p. 447 and vol. 185, 1927, p. 380; *Revolution in Modern Physics*, Routledge & Kegan Paul, London, 1954.
10 D. Bohm and J. V. Vigier, *Phys. Rev.*, vol. 96, 1954, p. 208.
11 For a more detailed discussion see Bohm, *Causality and Chance in Modern Physics*, ch. 4.
12 Bohm and Vigier, *op. cit.*; Bohm, *Causality and Chance in Modern Physics*.
13 Bohm, *Phys. Rev.*, vol. 85, 1952, pp. 166, 180; Bohm and Vigier, *op. cit.*; Bohm, *Causality and Chance in Modern Physics*.
14 Bohm and Vigier, *op. cit.*
15 Bohm, *Phys. Rev.*, vol. 85, 1952, pp. 166, 180; Bohm and Vigier, *op.cit.*; Bohm, *Causality and Chance in Modern Physics*.
16 G. Kallen, *Physica*, vol. 19, 1953, p. 850; *Kgl Danske Videnskab. Selskab, Matfys. Medd.*, vol. 27, no. 12, 1953; *Nuovo Cimento*, vol. 12, 1954,

p. 217; A. S. Wightman, *Phys. Rev.*, vol. 98, 1955, p. 812; L. van Hove, *Physica*, vol. 18, 1952, p. 145.

17 *Ibid.*

18 Private communications.

19 Private communications.

20 Van Hove, *op. cit.*; private communications.

21 A similar result is obtained when one treats the large-scale properties of an aggregate containing a great number of interacting particles. One obtains collective properties (e.g., oscillations) that determine themselves almost independently of the details of individual particle motions. See D. Bohm and D. Pines, *Phys. Rev.*, vol. 85, 1953, p. 338 and vol. 92, 1953, p. 609.

22 This analogy was first shown by Fürth for the case of Brownian motion of a particle. See Bohm, *Causality and Chance in Modern Physics*, ch. 4.

23 Bohm and Pines, *op. cit.*

24 M. Born, *Mechanics of the Atom*, Bell, London, 1927; H. Goldstein, *Classical Mechanics*, Addison-Wesley, Cambridge, Mass., 1953.

25 *Ibid.*

26 Born, *op. cit.*

27 Private communication.

28 For example, a synchronous electric motor tends to run in phase with the alternating current coming from the generator. There are innumerable other such examples in the theory of non-linear oscillations. A fuller discussion of non-linear oscillations is given by H. Jehle and J. Cahn, *Am. J. Phys.*, vol. 21, 1953, p. 526.

29 Born, *op. cit.*

30 Somewhat more general linear combinations can be taken but they only serve to complicate the expressions without changing the basic features of the problem.

31 D. Bohm and Y. Aharonov, *Phys. Rev.*, vol. 108, 1957, p. 1070.

5 QUANTUM THEORY AS AN INDICATION OF A NEW ORDER IN PHYSICS. PART A

1 This notion of order was first suggested to me in a private communication by a well-known artist, C. Biederman. For a presentation of his views see C. Biederman, *Art as the Evolution of Visual Knowledge*, Red Wing, Minnesota, 1948.

2 M. Born and N. Wiener, *J. Math. Phys.*, vol. 5, 1926, pp. 84–98; N. Wiener and A. Siegel, *Phys. Rev.*, vol. 91, 1953, p. 1551.

3 This notion has been discussed in chapters 1 and 3 from another point of view.
4 For a discussion of this point see D. Bohm, *Quantum Theory*, Prentice-Hall, New York, 1951.
5 For an extensive discussion of this effect see *ibid*, ch. 22; for a later point of view on this subject see J. S. Bell, *Rev. Mod. Phys.*, vol. 38, 1966, p. 447.
6 N. Bohr, *Atomic Theory and the Description of Nature*, Cambridge University Press, 1934.
7 J. von Neumann, *Mathematical Foundations of Quantum Mechanics*, Princeton University Press, 1955.

6 QUANTUM THEORY AS AN INDICATION OF A NEW ORDER IN PHYSICS. PART B

1 For a very clear presentation of this view see T. Kuhn, *The Nature of Scientific Revolutions*, University of Chicago Press, 1955.
2 J. Piaget, *The Origin of Intelligence in the Child*, Routledge & Kegan Paul, London, 1956.
3 See D. Bohm, B. Hiley and A. Stuart, *Progr. Theoret. Phys.*, vol. 3, 1970, p. 171, where this description of a perceived content considered as the intersection of two orders is treated in a different context.
4 See, for example, D. F. Littlewood, *The Skeleton Key of Mathematics*, Hutchinson, London, 1960.
5 See, for example, *ibid*.

7 THE ENFOLDING-UNFOLDING UNIVERSE AND CONSCIOUSNESS

1 See *Re-Vision*, vol. 3, no. 4, 1978, for a treatment of this subject in a different way. (Published at 20 Longfellow Road, Cambridge, Mass. 02148, USA.)
2 See D. Bohm, *Causality and Chance in Modern Physics*, Routledge & Kegan Paul, London, 1957, ch. 2, for a further discussion of this point.
3 For a more detailed discussion of this point see, for example, D. Bohm and B. Hiley, *Foundations of Physics*, vol. 5, 1975, p. 93.
4 For a detailed discussion of this experiment see D. Bohm, *Quantum Theory*, Prentice-Hall, New York, 1951, ch. 22.
5 See D. Bohm, *Causality and Chance in Modern Physics*, ch. 2, for a discussion of this feature of 'indeterministic mechanism'.

6 See D. Bohm and B. Hiley, *Foundations of Physics*, vol. 5, 1975, p. 93, and D. Bohm, *Quantum Theory*, Prentice-Hall, New York, 1951, for a more detailed treatment of this feature of the quantum theory.

7 Mathematically one derives all the properties of the system from a 3*N*-dimensional 'wave function' (where *N* is the number of particles) which cannot be represented in three-dimensional space alone. Physically one actually finds the non-local, non-causal relationship of distant elements described above, which corresponds very well with what is implied by the mathematical equations.

8 Notably those in which the 'wave function' of the combined system can be factored approximately into two separate three-dimensional wave functions (as shown in Bohm and Hiley, *op. cit.*).

9 This is just an example of the combination of wavelike and particle-like properties of matter described in section 2.

10 This sort of calculation is suggested in D. Bohm, *Causality and Chance in Modern Physics*, Routledge & Kegan Paul, London, 1957, p. 163.

11 In section 8 we shall see that time, as well as space, may be enfolded in this way.

12 Compare with the idea of sub-system, system, and super-system, suggested in Bohm and Hiley, *op. cit*.

13 This notion has already been suggested in a preliminary way in chapter 3.

14 See Karl Pribram, *Languages of the Brain*, G. Globus *et al*. (eds), 1971; *Consciousness and the Brain*, Plenum, New York, 1976.

15 E.g., as shown in section 3, a linearly ordered array of droplets may be enfolded together in such a way that this order is still subtly held in the whole set of ensembles of ink particles.

16 As shown in the appendix to chapter 6, on the implicate order the basic algorithm is an *algebra* rather than the calculus.

17 For a more detailed discussion, see D. Bohm, *The Special Theory of Relativity*, Benjamin, New York, 1965, Appendix.

18 See *ibid*.

19 This illusion is essentially the one discussed in chapters 1 and 2, in which the whole of existence is seen as constituted of basically static fragments.

20 In some ways this idea of an 'unconscious' background is similar to that of Freud. However, in Freud's point of view the unconscious has a fairly definite and limited kind of content and is thus not comparable to the immensity of the background that we are proposing. Perhaps

Freud's 'oceanic feeling' would be somewhat closer to the latter than would be his notion of the unconscious.

21 This corresponds to the quantum theoretical requirement that electrons may go from one state in space to another without passing through intermediate states.

HOLOGRAPHIC UNIVERSE

M. TALBOT

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If there is anyone that I have inadvertently left out, please forgive me. To all, both named and unnamed, who have helped me give birth to this book, my heartfelt thanks.

Introduction

In the movie *Star Wars,* Luke Skywalker's adventure begins when a beam of light shoots out of the robot Artoo Detoo and projects a miniature three-dimensional image of Princess Leia. Luke watches spellbound as the ghostly sculpture of light begs for someone named Obi-wan Kenobi to come to her assistance. The image is a *hologram,* a three-dimensional picture made with the aid of a laser, and the technological magic required to make such images is remarkable. But what is even more astounding is that some scientists are beginning to believe the universe itself is a kind of giant hologram, a splendidly detailed illusion no more or less real than the image of Princess Leia that starts Luke on his quest.

Put another way, there is evidence to suggest that our world and everything in it—from snowflakes to maple trees to falling stars and spuming electrons—are also only ghostly images, projections from a level of reality so beyond our own it is literally beyond both space and time.

The main architects of this astonishing idea are two of the world's most eminent thinkers: University of London physicist David Bohm, a protege of Einstein's and one of the world's most respected quantum physicists; and Karl Pribram, a neurophysiologist at Stanford University and author of the classic neuropsychological textbook *Languages of the Brain.* Intriguingly, Bohm and Pribram arrived at their conclusions independently and while working from two very different directions. Bohm became convinced of the universe's holographic nature

only after years of dissatisfaction with standard theories* inability to explain all of the phenomena encountered in quantum physics. Pribram became convinced because of the failure of standard theories of the brain to explain various neurophysiological puzzles.

However, after arriving at their views, Bohm and Pribram quickly realized the holographic model explained a number of other mysteries as weli, including the apparent inability of any theory, no matter how comprehensive, ever to account for all the phenomena encountered in nature; the ability of individuals with hearing in only one ear to determine the direction from which a sound originates; and our ability to recognize the face of someone we have not seen for many years even if that person has changed considerably in the interim.

But the most staggering thing about the holographic model was that it suddenly made sense of a wide range of phenomena so elusive they generally have been categorized outside the province of scientific understanding. These include telepathy, precognition, mystical feelings of oneness with the universe, and even psychokinesis, or the ability of the mind to move physical objects without anyone touching them.

Indeed, it quickly became apparent to the ever growing number of scientists who came to embrace the holographic model that it helped explain virtually all paranormal and mystical experiences, and in the last half-dozen years or so it has continued to galvanize researchers and shed light on an increasing number of previously inexplicable phenomena. For example:

- In 1980 University of Connecticut psychologist Dr. Kenneth fling proposed that near-death experiences could be explained by the holographic model. Ring, who is president of the International Association for Near-Death Studies, believes such experiences, as well as death itself, are really nothing more than the shifting of a person's consciousness from one level of the hologram of reality to another.
- In 1985 Dr. Stanistav Grof, chief of psychiatric research at the Maryland Psychiatric Research Center and an assistant professor of psychiatry at the Johns Hopkins University School of Medicine, published a book in which he concluded that existing neurophysiological models of the brain are inadequate and only a holographic model can explain such things as archetypal experiences, encounters with the collective unconscious, and other unusual phenomena experienced during altered states of consciousness.

- At the 1987 annual meeting of the Association for the Study of Dreams held in Washington, D.C., physicist Fred Alan Wolf delivered a talk in which he asserted that the holographic model explains lucid dreams (unusually vivid dreams in which the dreamer realizes he or she is awake). Wolf believes such dreams are actually visits to parallel realities, and the holographic model will ultimately allow us to develop a "physics of consciousness" which will enable us to begin to explore more fully these other-dimensional levels of existence.
- In his 1987 book entitled *Synckronicity: The Bridge Between Matter and Mind,* Dr. F. David Peat, a physicist at Queen's University in Canada, asserted that synchronic!ties (coincidences that are so unusual and so psyc ho logically meaningful they don't seem to be the result of chance alone) can be explained by the holographic model. Peat believes such coincidences are actually "flaws in the fabric of reality." They reveal that our thought processes are much more intimately connected to the physical world than has been hitherto suspected.

These are only a few of the thought-provoking ideas that will be explored in this book. Many of these ideas are extremely controversial. Indeed, the holographic model itself is highly controversial and is by no means accepted by a majority of scientists. Nonetheless, and as we shall see, many important and impressive thinkers do support it and believe it may be the most accurate picture of reality we have to date.

The holographic model has also received some dramatic experimental support. In the field of neurophysiology numerous studies have corroborated Pribram's various predictions about the holographic nature of memory and perception. Similarly, in 1982 a landmark experiment performed by a research team led by physicist Alain Aspect at the Institute of Theoretical and Applied Optics, in Paris, demonstrated that the web of subatomic particles that compose our physical universe—the very fabric of reality itself—possesses what appears to be an undeniable "holographic" property. These findings will also be discussed in the book.

In addition to the experimental evidence, several other things add weight to the holographic hypothesis. Perhaps the most important considerations are the character and achievements of the two men who originated the idea. Early in their careers, and before the holographic model was even a glimmer in their thoughts, each amassed accomplishments that would inspire most researchers to spend the rest of

their academic lives resting on their laurels. In the 1940s Pribram did pioneering work on the limbic system, a region of the brain involved in emotions and behavior. Bohm's work in plasma physics in the 1950s is also considered landmark.

But even more significantly, each has distinguished himself in another way. It is a way even the most accomplished men and women can seldom call their own, for it is measured not by mere intelligence or even talent It is measured by courage, the tremendous resolve it takes to stand up for one's convictions even in the face of overwhelming opposition. While he was a graduate student, Bohm did doctoral work with Robert Oppenheimer. Later, in 1951, when Oppenheimer came under the perilous scrutiny of Senator Joseph McCarthy's Committee on Un-American Activities, Bohm was called to testify against him and refused. As a result he lost his job at Princeton and never again taught in the United States, moving first to Brazil and then to London.

Early in his career Pribram faced a similar test of mettle. In 1935 a Portuguese neurologist named Egas Moniz devised what he believed was the perfect treatment for mental illness. He discovered that fay boring into an individual's skull with a surgical pick and severing the prefrontal cortex from the rest of the brain he could make the most troublesome patients docile. He called the procedure a *prefrontal lobotomy,* and by the 1940s it had become such a popular medical technique that Moniz was awarded the Nobel Prize. In the 1950s the procedure's popularity continued and it became a tool, like the McCarthy hearings, to stamp out cultural undesirables. So accepted was its use for this purpose that the surgeon Walter Freeman, the most outspoken advocate for the procedure in the United States, wrote unashamedly that lobotomies "made good American citizens" out of society's misfits, "schizophrenics, homosexuals, and radicals."

During this time Pribram came on the medical scene. However, unlike many of his peers, Pribram felt it was wrong to tamper so recklessly with the brain of another. So deep were his convictions that while working as a young neurosurgeon in Jacksonville, Florida, he opposed the accepted medical wisdom of the day and refused to allow any lobotomies to be performed in the ward he was overseeing. Later at Yale he maintained his controversial stance, and his then radical views very nearly lost him his job.

Bohm and Pribram's commitment to stand up for what they believe in, regardless of the consequences, is also evident in the holographic model. As we shall see, placing their not inconsiderable reputations

behind such a controversial idea is not the easiest path either could have taken. Both their courage and the vision they have demonstrated in the past again add weight to the holographic idea.

One final piece of evidence in favor of the holographic model is the paranormal itself. This is no small point, for in the last several decades a remarkable body of evidence has accrued suggesting that our current understanding of reality, the solid and comforting sticks-and-stones picture of the world we all learned about in high-school science class, is wrong. Because these findings cannot be explained by any of our standard scientific models, science has in the main ignored them. However, the volume of evidence has reached the point where this is no longer a tenable situation.

To give just one example, in 1987, physicist Robert G. Jahn and clinical psychologist Brenda J. Dunne, both at Princeton University, announced that after a decade of rigorous experimentation by their Princeton Engineering Anomalies Research Laboratory, they had accumulated unequivocal evidence that the mind can psychically interact with physical reality. More specifically, Jahn and Dunne found that through mental concentration alone, human beings are able to affect the way certain kinds of machines operate. This is an astounding finding and one that cannot be accounted for in terms of our standard picture of reality.

It can be explained by the holographic view, however. Conversely, because paranormal events cannot be accounted for by our current scientific understandings, they cry out for a new way of looking at the universe, a new scientific paradigm. In addition to showing how the holographic model can account for the paranormal, the book will also examine how mounting evidence in favor of the paranormal in turn actually seems to necessitate the existence of such a model.

The fact that the paranormal cannot be explained by our current scientific worldview is only one of the reasons it remains so controversial. Another is that psychic functioning is often very difficult to pin down in the lab, and this has caused many scientists to conclude it therefore does not exist. This apparent elusiveness will also be discussed in the book.

An even more important reason is that contrary to what many of us have come to believe, science is not prejudice-free. I first learned this a number of years ago when I asked a well-known physicist what he thought about a particular parapsychological experiment. The physicist {who had a reputation for being skeptical of the paranormal)

looked at me and with great authority said the results revealed "no evidence of any psychic functioning whatsoever." I had not yet seen the results, but because I respected the physicist's intelligence and reputation, I accepted his judgment without question. Later when I examined the results for myself, I was stunned to discover the experiment had produced very striking evidence of psychic ability. I realized then that even well-known scientists can possess biases and blind spots.

Unfortunately this is a situation that occurs often in the investigation of the paranormal. In a recent article in *American Psychologist,* Yale psychologist Irvin L. Child examined how a well-known series of ESP dream experiments conducted at the Maimonides Medical Center in Brooklyn, New York, had been treated by the scientific establishment. Despite the dramatic evidence supportive of ESP uncovered by the experimenters, Child found their work had been almost completely ignored by the scientific community. Even more distressing, in the handful of scientific publications that had bothered to comment on the experiments, he found the research had been so "severely distorted" its importance was completely obscured.[1]

How is this possible? One reason is science is not always as objective as we would like to believe. We view scientists with a bit of awe, and when they tell us something we are convinced it must be true. We forget they are only human and subject to the same religious, philosophical, and cultural prejudices as the rest of us. This is unfortunate, for as this book will show, there is a great deal of evidence that the universe encompasses considerably more than our current worldview allows.

But why is science so resistant to the paranormal in particular? This is a more difficult question. In commenting on the resistance he experienced to his own unorthodox views on health, Yale surgeon Dr. Bernie S. Siegel, author of the best-selling book *Love, Medicine, and Miracles,* asserts that it is because people are addicted to their beliefs. Siegel says this is why when you try to change someone's belief they act like an addict

There seems to be a good deal of truth to Siegel's observation, which perhaps is why so many of civilization's greatest insights and advances have at first been greeted with such passionate denial. We *are* addicted to our beliefs and we *do* act like addicts when someone tries to wrest from us the powerful opium of our dogmas. And since West-

ern science has devoted several centuries to not believing in the paranormal, it is not going to surrender its addiction lightly.

I am lucky. I have always known there was more to the world than is generally accepted. I grew up in a psychic family, and from an early age I experienced firsthand many of the phenomena that will be talked about in this book. Occasionally, and when it is relevant to the topic being discussed, 1 will relate a few of my own experiences. Although they can only be viewed as anecedotal evidence, for me they have provided the most compelling proof of all that we live in a universe we are only just beginning to fathom, and I include them because of the insight they offer.

Lastly, because the holographic concept is still very much an idea in the making and is a mosaic of many different points of view and pieces of evidence, some have argued that it should not be called a model or theory until these disparate points of view are integrated into a more unified whole. As a result, some researchers refer to the ideas as the *holographic paradigm.* Others prefer *holographic analogy, holographic metaphor,* and so on. In this book and for the sake of diversity I have employed all of these expressions, including *holographic model* and *holographic theory,* but do not mean to imply that the holographic idea has achieved the status of a model or theory in the strictest sense of these terms.

In this same vein it is important to note that although Bohm and Pribram are the originators of the holographic idea, they do not embrace all of the views and conclusions put forward in this book. Rather, this is a book that looks not only at Bohm and Pribram's theories, but at the ideas and conclusions of numerous researchers who have been influenced by the holographic model and who have interpreted it in their own sometimes controversial ways.

Throughout this book I also discuss various ideas from quantum physics, the branch of physics that studies subatomic particles (electrons, protons, and so on). Because I have written on this subject before, I am aware that some people are intimidated by the term *quantum physics* and are afraid they will not be able to understand its concepts. My experience has taught me that even those who do not know any mathematics are able to understand the kinds of ideas from physics that are touched upon in this book. You do not even need a background in science. All you need is an open mind if you happen to glance at a page and see a scientific term you do not know. I have kept

such terms down to a minimum, and on those occasions when it was necessary to use one, I always explain it before continuing on with the text

So don't be afraid. Once you have overcome your "fear of the water," I think you'll find swimming among quantum physics' strange and fascinating ideas much easier than you thought. I think you'll also find that pondering a few of these ideas might even change the way you look at the world. In fact, it is my hope that the ideas contained in the following chapters *will* change the way you look at the world. It is with this humble desire that I offer this book.

PART I

A REMARKABLE NEW VIEW OF REALITY

Sit down before foct like a little child, and be prepared to give up every preconceived notion, follow humbly wherever and to whatever abyss Nature leads, or you shall learn nothing.

—T. H. Huxley

I

The Brain as Hologram

It isn't that the world of appearances is wrong; it isn't that there *aren't* objects out there, at one level of reality. It's that if you penetrate through and look at the universe with a holographic system, you arrive at a different view, a different reality. And that other reality can explain things that have hitherto remained inexplicable scientifically: paranormal phenomena, synchronicities, the apparently meaningful coincidence of events.

—Karl Pribram
in an interview in *Psychology Today*

The puzzle that first started Pribram on the road to formulating his holographic model was the question of how and where memories are stored in the brain. In the early 1940s, when he first became interested in this mystery, it was generally believed that memories were localized in the brain. Each memory a person had, such as the memory of the last time you saw your grandmother, or the memory of the fragrance of a gardenia you sniffed when you were sixteen, was believed to have a specific location somewhere in the brain cells. Such memory traces were called *engrains,* and although no one knew what an engram was made of—whether it was a neuron or perhaps even a special kind of molecule—most scientists were confident it was only a matter of time before one would be found. There were reasons for this confidence. Research conducted by Ca-

nadian neurosurgeon Wilder Penfield in the 1920s had offered convincing evidence that specific memories did have specific locations in the brain. One of the most unusual features of the brain is that the object itself doesn't sense pain directly. As long as the scalp and skull have been deadened with a local anesthetic, surgery can be performed on the brain of a fully conscious person without causing any pain.

In a series of landmark experiments, Penfield used this fact to his advantage. While operating on the brains of epileptics, he would electrically stimulate various areas of their brain cells. To his amazement he found that when he stimulated the temporal lobes (the region of the brain behind the temples) of one of his fully conscious patients, they reexperienced memories of past episodes from their lives in vivid detail. One man suddenly relived a conversation he had had with friends in South Africa; a boy heard his mother talking on the telephone and after several touches from Penfield's electrode was able to repeat her entire conversation; a woman found herself in her kitchen and could hear her son playing outside. Even when Penfield tried to mislead his patients by telling them he was stimulating a different area when he was not, he found that when he touched the same spot it always evoked the same memory.

In his book *The Mystery of the Mind,* published in 1975, just shortly before his death, he wrote, "It was evident at once that these were not dreams. They were electrical activations of the sequential record of consciousness, a record that had been laid down during the patient's earlier experience. The patient 're-lived' all that he had been aware of in that earlier period of time as in a moving-picture 'flashback.' '[M]

From his research Penfield concluded that everything we have ever experienced is recorded in our brain, from every stranger's face we have glanced at in a crowd to every spider web we gazed at as a child. He reasoned that this was why memories of so many insignificant events kept cropping up in his sampling. If our memory is a complete record of even the most mundane of our day-to-day experiences, it is reasonable to assume that dipping randomly into such a massive chronicle would produce a good deal of trifling information.

As a young neurosurgery resident, Pribram had no reason to doubt Penfield's engram theory. But then something happened that was to change his thinking forever. In 1946 he went to work with the great neuropsychologist Karl Lashley at the Yerkes Laboratory of Primate Biology, then in Orange Park, Florida. For over thirty years Lashley had been involved in his own ongoing search for the elusive mechanisms responsible for memory, and there Pribram was able to witness the fruits of Lashley's labors firsthand. What was startling was that not only had Lashley failed to produce any evidence of the en-gram, but his research actually seemed to pull the rug out from under all of Penfield's findings.

What Lashley had done was to train rats to perform a variety of tasks, such as run a maze. Then he surgically removed various portions of their brains and retested them. His aim was literally to cut out the area of the rats' brains containing the memory of their maze-running ability. To his surprise he found that no matter what portion of their brains he cut out, he could not eradicate their memories. Often the rats' motor skills were impaired and they stumbled clumsily through the mazes, but even with massive portions of their brains removed, their memories remained stubbornly intact.

For Pribram these were incredible findings. If memories possessed specific locations in the brain in the same way that books possess specific locations on library shelves, why didn't Lashley's surgical plunderings have any effect on them? For Pribram the only answer seemed to be that memories were not localized at specific brain sites, but were somehow spread out or *distributed* throughout the brain as a whole. The problem was that he knew of no mechanism or process that could account for such a state of affairs.

Lashley was even less certain and later wrote, ,[l]I sometimes feel, in reviewing the evidence on the localization of the memory trace, that the necessary conclusion is that learning just is not possible at all. Nevertheless, in spite of such evidence against it, learning does sometimes occur."[2] In 1948 Pribram was offered a position at Yale, and before leaving he helped write up thirty years of Lashley's monumental research.

The Breakthrough

At Yale, Pribram continued to ponder the idea that memories were distributed throughout the brain, and the more he thought about it the more convinced he became. After all, patients who had had portions of their brains removed for medical reasons never suffered the loss of specific memories. Removal of a large section of the brain might cause a patient's memory to become generally hazy, but no one ever came

out of surgery with any selective memory loss. Similarly, individuals who had received head injuries in car collisions and other accidents never forgot half of their family, or half of a novel they had read. Even removal of sections of the temporal lobes, the area of the brain that had figured so prominently in Penfield's research, didn't create any gaps in a person's memories.

Pribram's thinking was further solidified by his and other researchers' inability to duplicate Penfield's findings when stimulating brains other than those of epileptics. Even Penfield himself was unable to duplicate his results in nonepileptic patients.

Despite the growing evidence that memories were distributed, Pribram was still at a loss as to how the brain might accomplish such a seemingly magical feat. Then in the mid-1960s an article he read in *Scientific American* describing the first construction of a hologram hit him like a thunderbolt. Not only was the concept of holography dazzling, but it provided a solution to the puzzle with which he had been wrestling.

To understand why Pribram was so excited, it is necessary to understand a little more about holograms. One of the things that makes holography possible is a phenomenon known as interference. Interference is the crisscrossing pattern that occurs when two or more waves, such as waves of water, ripple through each other. For example, if you drop a pebble into a pond, it will produce a series of concentric waves that expands outward. If you drop two pebbles into a pond, you will get two sets of waves that expand and pass through one another. The complex arrangement of crests and troughs that results from such collisions is known as an interference pattern.

Any wavelike phenomena can create an interference pattern, including light and radio waves. Because laser light is an extremely pure, coherent form of light, it is especially good at creating interference patterns. It provides, in essence, the perfect pebble and the perfect pond. As a result, it wasn't until the invention of the laser that holograms, as we know them today, became possible.

A hologram is produced when a single laser light is split into two separate beams. The first beam is bounced off the object to be photographed. Then the second beam is allowed to collide with the reflected tight of the first. When this happens they create an interference pattern which is then recorded on a piece of film (see fig, 1).

To the naked eye the image on the film looks nothing at all like the object photographed. In fact, it even looks a little like the concentric rings that form when a handful of pebbles is tossed into a pond (see fig. 2). But as soon as another laser beam (or in some instances just a bright light source) is shined through the film, a three-dimensional image of the original object reappears. The three-dimen3ionahty of such images is often eerily convincing. You can actually walk around a holographic projection and view it from different angles as you would a real object. However, if you reach out and try to touch it, your hand will waft right through it and you will discover there is really nothing there (see fig. 3).

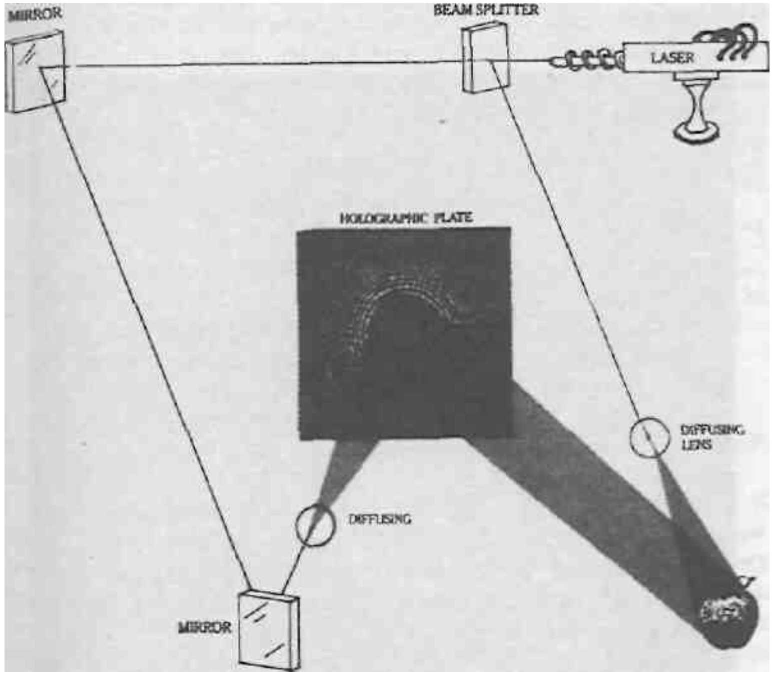
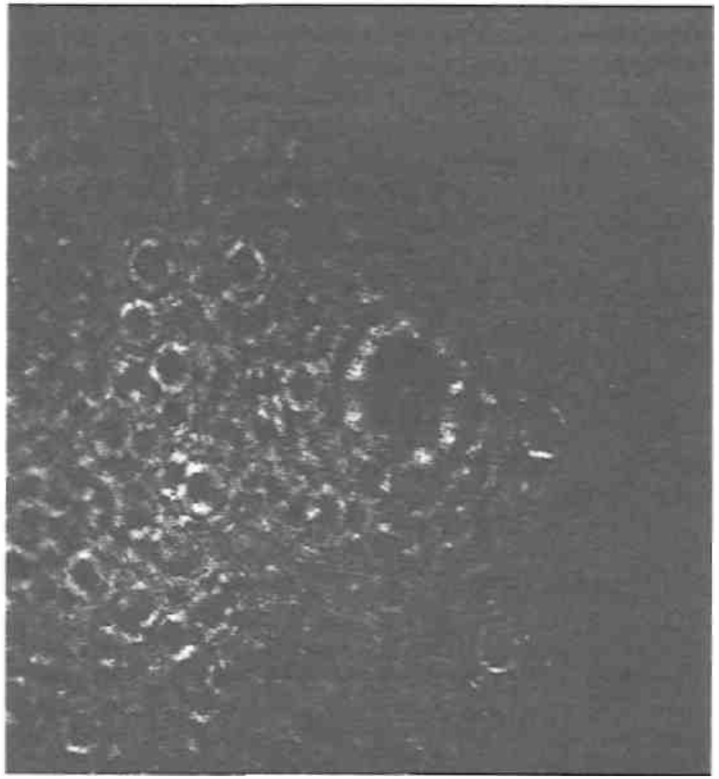


FIGURE 1. A hologram is produced when a single laser light is split into two separate beaniE. Tbe first beam is bounced off the object to be photographed, in this case an apple. Then the second beam is allowed to collide with the reflected light of the first, and the resulting interference pattern is recorded on film.

Three-dimensionality is not the only remarkable aspect of holograms. If a piece of holographic film containing the image of an apple is cut in half and then illuminated by a laser, each half will still be found to contain the entire image of the apple! Even if the halves are divided again and then again, an entire apple can still be reconstructed from each small portion of the film {although the images will get hazier as the portions get smaller). Unlike normal photographs, every

FIGUHE *2.* A piece of holographic film containing an encoded image. To the naked eye the image on the film looks nothing like the object photographed and is composed of irregular ripples known as *interference patterns.* However, when the film is illuminated with another laser, a three-dimensional image of the original object reappears.



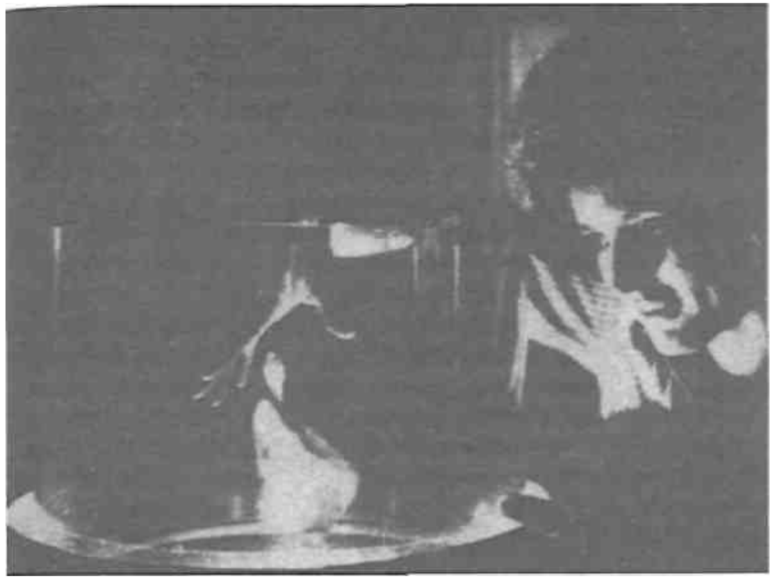


FIGURE 3. The three-dimensionality of a hologram is often so eerily convincing that you can actually walk around it and view it from different angles. But if you reach out and try to touch it, your hand will waft right through it ["Celeste Undressed." Holographic stereogram by Peter Claudius, 1978. Photograph by Brad Cantos, collection of The Museum of Holography. Used by permission]

small fragment of a piece of holographic film contains all the information recorded in the whole (see fig. 4).*

This was precisely the feature that got Pribram so excited, for it offered at last a way of understanding how memories could be distributed rather than localized in the brain. If it was possible for every portion of a piece of holographic film to contain all the information necessary to create a whole image, then it seemed equally possible for every part of the brain to contain all of the information necessary to recall a whole memory.

"It should be noted that this astounding trait is common only to pieces of holographic film whose images are invisible to the naked eye. If you buy a piece of holographic film (or an object containing a piece of holographic film) in a store and can see a three-dimensional image in it without any special kind of illumination, do not cut it in half. You will only end UP with pieces of the original image.

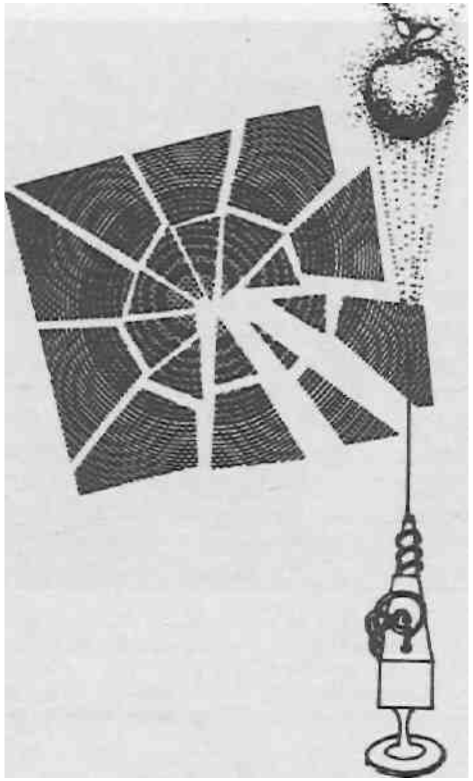


FIGURE 4. Uniike normal photographs, every portion of a piece of holographic film contains all of the information of the *whole.* Thus if a holographic plate *is* broken into fragments, each piece can still be used to reconstruct the entire image.

Vision Also Is Holographic

Memory is not the only thing the brain may process holographically. Another of Lashley's discoveries was that the visual centers of the brain were also surprisingly resistant to surgical excision. Even after removing as much as 90 percent of a rat's visual cortex {the part of the brain that receives and interprets what the eye sees), he found it could still perform tasks requiring complex visual skills. Similarly, research conducted by Pribram revealed that as much as 98 percent

of a cat's optic nerves can be severed without seriously impairing its ability to perform complex visual tasks.[3]

Such a situation was tantamount to believing that a movie audience could still enjoy a motion picture even after 90 percent of the movie screen was missing, and his experiments presented once again a serious challenge to the standard understanding of how vision works. According to the leading theory of the day, there was a one-to-one correspondence between the image the eye sees and the way that image is represented in the brain. In other words, when we look at a square, it was believed the electrical activity in our visual cortex also possesses the form of a square (see fig. 5).

Although findings such as Lashley's seemed to deal a deathblow to this idea, Pribram was not satisfied. While he was at Yale he devised a series of experiments to resolve the matter and spent the next seven years carefully measuring the electrical activity in the brains of monkeys while they performed various visual tasks. He discovered that not only did no such one-to-one correspondence exist, but there wasn't even a discernible pattern to the sequence in which the electrodes fired. He wrote of his findings, "These experimental results are incompatible with a view that a photographic-like image becomes projected onto the cortical surface."[4]

FIGURE 5. Vision theorists once believed there was a one-to-one correspondence between an image the eye sees and how that image is represented in the brain. Pribram discovered this is not true.

Once again the resistance the visual cortex displayed toward surgical excision suggested that, like memory, vision was also distributed, and after Pribram became aware of holography he began to wonder if it, too, was holographic. The "whole in every part" nature of a hologram certainly seemed to explain how so much of the visual cortex could be removed without affecting the ability to perform visual tasks. If the brain was processing images by employing some kind of internal hologram, even a very small piece of the hologram could still reconstruct the whole of what the eyes were seeing. It also explained the lack of any one-to-one correspondence between the external world and the brain's electrical activity. Again, if the brain was using holographic principles to process visual information, there would be no more one-to-one correspondence between electrical activity and images seen than there was between the meaningless swirl of interference patterns on a piece of holographic film and the image the film encoded.

The only question that remained was what wavelike phenomenon the brain might be using to create such internal holograms. As soon as Pribram considered the question he thought of a possible answer. It was known that the electrical communications that take place between the brain's nerve cells, or neurons, do not occur alone. Neurons possess branches like little trees, and when an electrical message reaches the end of one of these branches it radiates outward as does the ripple in a pond. Because neurons are packed together so densely, these expanding ripples of electricity—also a wavelike phenomenon— are constantly crisscrossing one another. When Pribram remembered this he realized that they were most assuredly creating an almost endless and kaleidoscopic array of interference patterns, and these in turn might be what give the brain its holographic properties. "The hologram was there all the time in the wave-front nature of brain-cell connectivity," observed Pribram. "We simply hadn't had the wit to realize it,"[5]

Other Puzzles Explained by the Holographic Brain Model

Pribram published his first article on the possible holographic nature of the brain in 1966, and continued to expand and refine his ideas

during the next several years. As he did, and as other researchers became aware of his theory, it was quickly realized that the distributed nature of memory and vision is not the only neurophysiologies! puzzle the holographic model can explain.

THE VASTNESS OF OUR MEMORY

Holography also explains how our brains can store so many memories in so little space. The brilliant Hungarian-born physicist and mathematician John von Neumann once calculated that over the course of the average human lifetime, the brain stores something on the order of 2.8 X 10^{20} (280,000,000,000,000,000,000) bits of information. This is a staggering amount of information, and brain researchers have long struggled to come up with a mechanism that explains such a vast capability.

Interestingly, holograms also possess a fantastic capacity for information storage. By changing the angle at which the two lasers strike a piece of photographic film, it is possible to record many different images on the same surface. Any image thus recorded can be retrieved simply by illuminating the film with a laser beam possessing the same angle as the original two beams. By employing this method researchers have calculated that a one-inch-square of film can store the same amount of information contained in fifty Bibles![6]

OUR ABILITY TO BOTH RECALL AND FORGET

Pieces of holographic film containing multiple images, such as those described above, also provide a way of understanding our ability to both recall and forget. When such a piece of film is held in a laser beam and tilted back and forth, the various images it contains appear and disappear in a glittering stream. It has been suggested that our ability to remember is analogous to shining a laser beam on such a piece of film and calling up a particular image. Similarly, when we are unable to recall something, this may be equivalent to shining various beams on a piece of multiple-image film, but failing to find the right angle to call up the image/memory for which we are searching.

ASSOCIATIVE MEMORY

In Proust's *Swann 's Way* a sip of tea and a bite of a small scallop-shaped cake known as a *petite madeleine* cause the narrator to find

himself suddenly flooded with memories from his past At first he is puzzled, but then, slowly, after much effort on his part, he remembers that his aunt used to give him tea and madeleines when he was a little boy, and it is this association that has stirred his memory. We have all had similar experiences—a whiff of a particular food being prepared, or a glimpse of some long-forgotten object—that suddenly evoke some scene out of our past

The holographic idea offers a further analogy for the associative tendencies of memory. This is illustrated by yet another kind of holographic recording technique. First, the light of a single laser beam is bounced off two objects simultaneously, say an easy chair and a smoking pipe. The light bounced off each object is then allowed to collide, and the resulting interference pattern is captured on film. Then, whenever the easy chair is illuminated with laser light and the light that reflects off the easy chair is passed through the film, a three-dimensional image of the pipe will appear. Conversely, whenever the same is done with the pipe, a hologram of the easy chair appears. So, if our brains function holographically, a similar process may be responsible for the way certain objects evoke specific memories from our past.

OUR ABILITY TO RECOGNIZE FAMILIAR THINGS

At first glance our ability to recognize familiar things may not seem so unusual, but brain researchers have long realized it is quite a complex ability. For example, the absolute certainty we feel when we spot a familiar face in a crowd of several hundred people is not just a subjective emotion, but appears to be caused by an extremely fast and reliable form of information processing in our brain.

In a 1970 artiele in the British science magazine *Nature,* physicist Pieter van Heerden proposed that a type of holography known as *recognition holography* offers a way of understanding this ability.* In recognition holography a holographic image of an object is recorded in the usual manner, save that the laser beam is bounced off a special kind of mirror known as *a. focusing mirror* before it is allowed to strike the unexposed film. If a second object, similar but not identical

"**Van** Heerden, a researcher at the Polaroid Research Laboratories m Cambridge, Massachusetts, actually proposed his own version of a hoiogrsphic theory of memory in 1963, buthia work went relatively unnoticed.

to the first, is bathed in laser light and the light is bounced off the mirror and onto the film after it has been developed, a bright point of light will appear on the film. The brighter and sharper the point of light, the greater the degree of similarity between the first and second objects. If the two objects are completely dissimilar, no point of light will appear. By placing a light-sensitive photocell behind the holographic film, one can actually use the setup as a mechanical recognition system.[7]

A similar technique known as *interference holography* may also explain how we can recognize both the familiar and unfamiliar features of an image such as the face of someone we have not seen for many years. In this technique an object is viewed through a piece of holographic film containing its image. When this is done, any feature of the object that has changed since its image was originally recorded will reflect light differently. An individual looking through the film is instantly aware of both how the object has changed and how it has remained the same. The technique is so sensitive that even the pressure of a finger on a block of granite shows up immediately, and the process has been found to have practical applications in the materials-testing industry.[8]

PHOTOGRAPHIC MEMORY

In 1972, Harvard vision researchers Daniel Pollen and Michael Trac-tenberg proposed that the holographic brain theory may explain why some people possess photographic memories {also known as *eidetic memories).* Typically, individuals with photographic memories will spend a few moments scanning the scene they wish to memorize. When they want to see the scene again, they "project" a mental image of it, either with their eyes closed or as they gaze at a blank wall or screen. In a study of one such individual, a Harvard art history professor named Elizabeth, Pollen and Tractenberg found that the mental images she projected were so real to her that when she read an image of a page from Goethe's *Faust* her eyes moved as if she were reading a real page.

Noting that the image stored in a fragment of holographic film gets hazier as the fragment gets smaller, Pollen and Tractenberg suggest that perhaps such individuals have more vivid memories because they somehow have access to very targe regions of their memory holo-

grams. Conversely, perhaps most of us have memories that are much less vivid because our access is limited to smaller regions of the memory holograms.[8]

THE TRANSFERENCE OF LEARNED SKILLS

Pribram believes the holographic model also sheds light on our ability to transfer learned skills from one part of our body to another. As you sit reading this book, take a moment and trace your first name in the air with your left elbow. You will probably discover that this is a relatively easy thing to do, and yet in all likelihood it is something you have never done before. It may not seem a surprising ability to you, but in the classic view that various areas of the brain {such as the area controlling the movements of the elbow) are "hard-wired," or able to perform tasks *only* after repetitive learning has caused the proper neural connections to become established between brain cells, this is something of a puzzle. Pribram points out that the problem becomes much more tractable if the brain were to convert all of its memories, including memories of learned abilities such as writing, into a language of interfering wave forms. Such a brain would be much more flexible and could shift its stored information around with the same ease that a skilled pianist transposes a song from one musical key to another.

This same flexibility may explain how we are able to recognize a familiar face regardless of the angle from which we are viewing it Again, once the brain has memorized a face (or any other object or scene) and converted it into a language of wave forms, it can, in a sense, tumble this interna] hologram around and examine it from any perspective it wants.

PHANTOM LIMB SENSATIONS AND HOW WE CONSTRUCT A "WORLD-OUT-THERE"

To most of us it is obvious that our feelings of love, hunger, anger, and so on, are internal realities, and the sound of an orchestra playing, the heat of the sun, the smell of bread baking, and so on, are external realities. But it is not so clear how our brains enable us to distinguish between the two. For example, Pribram points out that when we look at a person, the image of the person is really on the surface of our

retinas. Yet we do not perceive the person as being on our retinas. We perceive them as being in the "world-out-there." Similarly, when we stub our toe we experience the pain in our toe. But the pain is not really in our toe. It is actually a neurophysiological process taking place somewhere in our brain. How then is our brain abie to take the multitude of neurophysiological processes that manifest as our experience, all of which are internal, and fool us into thinking that some are internal and some are located beyond the confines of our gray matter?

Creating the illusion that things *are* located where they are not is the quintessential feature of a hologram. As mentioned, if you look at a hologram it seems to have extension in space, but if you pass your hand through it you will discover there is nothing there. Despite what your senses tell you, no instrument will pick up the presence of any abnormal energy or substance where the hologram appears to be hovering. This is because a hologram is a *virtual* image, an image that appears to be where it is not, and possesses no more extension in space than does the three-dimensional image you see of yourself when you look in a mirror. Just as the image in the mirror is located in the silvering on the mirror's back surface, the actual location of a hologram is always in the photographic emulsion on the surface of the film recording it.

Further evidence that the brain is able to Tool us into thinking that inner processes are located outside the body comes from the Nobel Prize-winning physiologist Georg von Bekesy. In a series of experiments conducted in the late 1960s Bekesy placed vibrators on the knees of blindfolded test subjects. Then he varied the rates at which the instruments vibrated. By doing so he discovered that he could make his test subjects experience the sensation that a point source of vibration was jumping from one knee to the other. He found that he could even make his subjects feel the point source of vibration in the space *between* their knees. In short, he demonstrated that humans have the ability to seemingly experience sensation in spatial locations where they have absolutely no sense receptors.[10]

Pribram believes that Bekesy's work is compatible with the holographic view and sheds additional light on how interfering wave fronts—or in Bekesy's case, interfering sources of physical vibration—enable the brain to localize some of its experiences beyond the physical boundaries of the body. He feels this process might also explain the phantom limb phenomenon, or the sensation experienced

by some amputees that a missing arm or leg is still present. Such individuals often feel eerily realistic cramps, pains, and tinglings in these phantom appendages, but maybe what they are experiencing is the holographic memory of the limb that is still recorded in the interference patterns in their brains.

Experimental Support for the Holographic Brain

For Pribram the many similarities between brains and holograms were tantalizing, but he knew his theory didn't mean anything unless it was backed up by more solid evidence. One researcher who provided such evidence was Indiana University biologist Paul Pietsch. Intrigu-ingly, Pietsch began as an ardent disbeliever in Pribram's theory. He was especially skeptical of Pribram's claim that memories do not possess any specific location in the brain.

To prove Pribram wrong, Pietsch devised a series of experiments, and as the test subjects of his experiments he chose salamanders. In previous studies he had discovered that he could remove the brain of a salamander without killing it, and although it remained in a stupor as long as its brain was missing, its behavior completely returned to normal as soon as its brain was restored.

Pietsch reasoned that if a salamander's feeding behavior is not confined to any specific location in the brain, then it should not matter how its brain is positioned in its head. If it did matter, Pribram's theory would be disproven. He then flip-flopped the left and right hemispheres of a salamander's brain, but to his dismay, as soon as it recovered, the salamander quickly resumed normal feeding.

He took another salamander and turned its brain upside down. When it recovered it, too, fed normally. Growing increasingly frustrated, he decided to resort to more drastic measures. In a series of over 700 operations he sliced, flipped, shuffled, subtracted, and even minced the brains of his hapless subjects, but always when he replaced what was left of their brains, their behavior returned to normal.[11]

These findings and others turned Pietsch into a believer and attracted enough attention that his research became the subject of a segment on the television show *60 Minutes.* He writes about this experience as well as giving detailed accounts of his experiments in his insightful book *Skujjtebrain.*

The Mathematical Language of **the Hologram**

While the theories that enabled the development of the hologram were first formulated in 1947 by Dennis Gabor (who later won a Nobel Prize for his efforts), in the late 1960s and early 1970s Pribram's theory received even more persuasive experimental support. When Gabor first conceived the idea of holography he wasn't thinking about lasers. His goal was to improve the electron microscope, then a primitive and imperfect device. His approach was a mathematical one, and the mathematics he used was a type of calculus invented by an eighteenth-century Frenchman named Jean E. J. Fourier.

Roughly speaking what Fourier developed was a mathematical way of converting any pattern, no matter how complex, into a language of simple waves. He also showed how these wave forms could be converted back into the original pattern. In other words, just as a television camera converts an image into electromagnetic frequencies and a television set converts those frequencies back into the original image, Fourier showed how a similar process could be achieved mathematically. The equations he developed to convert images into wave forms and back again are known as *Fourier transforms.*

Fourier transforms enabled Gabor to convert a picture of an object into the blur of interference patterns on a piece of holographic film. They also enabled him to devise a way of converting those interference patterns back into an image of the original object. In fact the special whole in every part of a hologram is one of the by-products that occurs when an image or pattern is translated into the Fourier language of wave forms.

Throughout the late 1960s and early 1970s various researchers contacted Pribram and told him they had uncovered evidence that the visual system worked as a kind of frequency analyzer. Since frequency is a measure of the number of oscillations a wave undergoes per second, this strongly suggested that the brain might be functioning as a hologram does.

But it wasn't until 1979 that Berkeley neurophysiologists Russell and Karen DeValois made the discovery that settled the matter. Research in the 1960s had shown that each brain cell in the visual cortex is geared to respond to a different pattern—some brain cells fire when the eyes see a horizontal line, others fire when the eyes see a vertical line, and so on. As a result, many researchers concluded that the brain takes input from these highly specialized cells called feature detec-

tors, and somehow fits them together to provide us with our visual perceptions of the world.

Despite the popularity of this view, the DeValoises felt it was only a partial truth. To test their assumption they used Fourier's equations to convert plaid and checkerboard patterns into simple wave forms. Then they tested to see how the brain cells in the visual cortex responded to these new wave-form images. What they found was that the brain cells responded not to the original patterns, but to the Fourier translations of the patterns. Only one conclusion could be drawn. The brain was using Fourier mathematics—the same mathematics holography employed—to convert visual images into the Fourier language of wave forms.[12]

The DeValoises' discovery was subsequently confirmed by numerous other laboratories around the world, and although it did not provide absolute proof the brain was a hologram, it supplied enough evidence to convince Pribram his theory was correct. Spurred on by the idea that the visual cortex was responding not to patterns but to the frequencies of various wave forms, he began to reassess the role frequency played in the other senses.

It didn't take long for him to realize that the importance of this role had perhaps been overlooked by twentieth-century scientists. Over a century before the DeValoises' discovery, the German physiologist and physicist Hermann von Helmholtz had shown that the ear was a frequency analyzer. More recent research revealed that our sense of smell seems to be based on what are called osmic frequencies. Bekesy's work had clearly demonstrated that our skin is sensitive to frequencies of vibration, and he even produced some evidence that taste may involve frequency analysis. Interestingly, Bekesy also discovered that the mathematical equations that enabled him to predict how his subjects would respond to various frequencies of vibration were also of the Fourier genre.

The Dancer as Wave Form

But perhaps the most startling finding Pribram uncovered was Russian scientist Nikolai Bernstein's discovery that even our physical movements may be encoded in our brains in a language of Fourier wave forms. In the 1930s Bernstein dressed people in black leotards

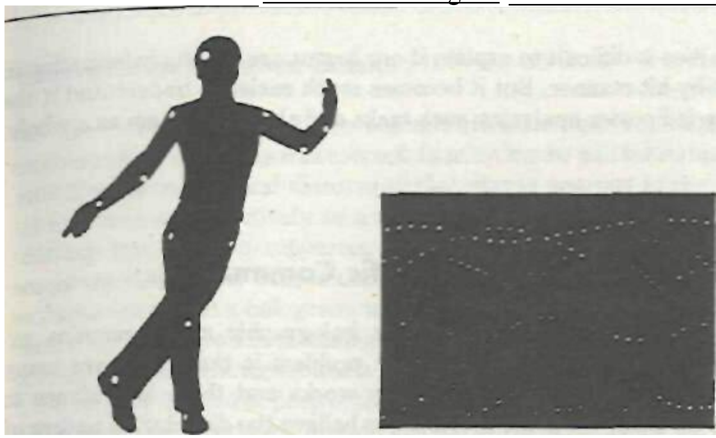


FIGURE 6. Russian researcher Nikolai Bernstein painted white dots on dancers and filmed them dancing against a black background. When he converted their movements into a language of wave forms, he discovered they could be analyzed using Fourier mathematics, the same mathematics Gabor used to invent the hologram.

and painted white dots on their elbows, knees, and other joints. Then he placed them against black backgrounds and took movies of them doing various physical activities such as dancing, walking, jumping, hammering, and typing.

When he developed the film, only the white dots appeared, moving up and down and across the screen in various complex and flowing movements (see fig. 6). To quantify his findings he Fourier-analyzed the various lines the dots traced out and converted them into a language of wave forms. To his surprise, he discovered the wave forms contained hidden patterns that allowed him to predict his subjects' next movement to within a fraction of an inch.

When Pribram encountered Bernstein's work he immediately recognized its implications. Maybe the reason hidden patterns surfaced after Bernstein Fourier-analyzed his subject's movements was because that was how movements are stored in the brain. This was an exciting possibility, for if the brain analyzed movements by breaking them down into their frequency components, it explained the rapidity with which we learn many complex physical tasks. For instance, we do not learn to ride a bicycle by painstakingly memorizing every tiny feature of the process. We learn fay grasping the whole flowing movement. The fluid wholeness that typifies how we learn so many physical

activities is difficult to explain if our brains are storing information in a bit-by-bit manner. But it becomes much easier to understand if the brain is Fourier-analyzing such tasks and absorbing them as a whole.

The Reaction of the Scientific Community

Despite such evidence, Pribram's holographic model remains extremely controversial. Part of the problem is that there are many popular theories of how the brain works and there is evidence to support them all. Some researchers believe the distributed nature of memory can be explained by the ebb and flow of various brain chemicals. Others hold that electrical fluctuations among large groups of neurons can account for memory and learning. Each school of thought has its ardent supporters, and it is probably safe to say that most scientists remain unpersuaded by Pribram's arguments. For example, neuropsychologist Frank Wood of the Bowman Gray School of Medicine in Winston-Salem, North Carolina, feels that "there are precious few experimental findings for which holography is the necessary, or even preferable, explanation."[13] Pribram is puzzled by statements such as Wood's and counters by noting that he currently has a book in press with well over 500 references to such data.

Other researchers agree with Pribram. Dr. Larry Dossey, former chief of staff at Medical City Dallas Hospital, admits that Pribram's theory challenges many long-held assumptions about the brain, but points out that "many specialists in brain function are attracted to the idea, if for no other reason than the glaring inadequacies of the present orthodox views."[14]

Neurologist Richard Restak, author of the PBS series *The Brain,* shares Dossey's opinion. He notes that in spite of overwhelming evidence that human abilities are holistically dispersed throughout the brain, most researchers continue to cling to the idea that function can be located in the brain in the same way that cities can be located on a map. Restak believes that theories based on this premise are not only "oversimplistie," but actually function as "conceptual straitjackets" that keep us from recognizing the brain's true complexities.[16] He feels that "a hologram is not only possible but, at this moment, represents probably our best 'model' for brain functioning."

Pribram Encounters Bohm

As for Pribram, by the 1970s enough evidence had accumulated to convince him his theory was correct. In addition, he had taken his ideas into the laboratory and discovered that single neurons in the motor cortex respond selectively to a limited bandwidth of frequencies, a finding that further supported his conclusions. The question that began to bother him was, If the picture of reality in our brains is not a picture at all but a hologram, what is it a hologram of? The dilemma posed by this question is analogous to taking a Polaroid picture of a group of people sitting around a table and, after the picture develops, finding that, instead of people, there are only blurry clouds of interference patterns positioned around the table. In both cases one could rightfully ask, Which is the true reality, the seemingly objective world experienced by the observer/photographer or the blur of interference patterns recorded by the camera/brain?

Pribram realized that if the holographic brain model was taken to its logical conclusions, it opened the door on the possibility that objective reality—the world of coffee cups, mountain vistas, elm trees, and table lamps—might not even exist, or at least not exist in the way we believe it exists. Was it possible, he wondered, that what the mystics had been saying for centuries was true, reality was *maya,* an illusion, and what was out there was really a vast, resonating symphony of wave forms, a "frequency domain" that was transformed into the world as we know it only *after* it entered our senses?

Realizing that the solution he was seeking might lie outside the province of his own field, he went to his physicist son for advice. His son recommended he look into the work of a physicist named David Bohm. When Pribram did he was electrified. He not only found the answer to his question, but also discovered that according to Bohm, the entire universe was a hologram.

2

The Cosmos as Hologram

> One can't help but be astonished at the degree to which [Bohm] has been *able to break* out of the tight molds of scientific conditioning and stand alone with a completely new and literally vast idea, one which has both internal consistency and the logical power to explain widely diverging phenomena of physical experience from an entirely unexpected point of view. ... It is a theory which is so intuitively satisfying that many people have felt that if the universe is not the way Bohm describes it, it ought to be.
>
> —John P. Briggs and F. David Peat
> *Looking Gloss Universe*

The path that led Bohm to the conviction that the universe is structured like a hologram began at the very edge of matter, in the world of subatomic particles. His interest in science and the way things work blossomed early. As a young boy growing up in Wilkes-Barre, Pennsylvania, he invented a dripless tea kettle, and his father, a successful businessman, urged him to try to turn a profit on the idea. But after learning that the first step in such a venture was to conduct a door-to-door survey to test-market his invention, Bohm's interest in business waned.[1]

His interest in science did not, however, and his prodigious curiosity forced him to look for new heights to conquer. He found the most challenging height of all in the 1930s when he attended Pennsylvania

State College, for it was there that he first became fascinated by quantum physics.

It is an easy fascination to understand. The strange new land that physicists had found lurking in the heart of the atom contained things more wondrous than anything Cortes or Marco Polo ever encountered. What made this new world so intriguing was that everything about it appeared to be so contrary to common sense. It seemed more like a land ruled by sorcery than an extension of the natural world, an Alice-in-Wonderland realm in which mystifying forces were the norm and everything logical had been turned on its ear.

One startling discovery made by quantum physicists was that if you break matter into smaller and smaller pieces you eventually reach a point where those pieces—electrons, protons, and so on—no longer possess the traits of objects. For example, most of us tend to think of an electron as a tiny sphere or a EB whizzing around, but nothing could be further from the truth. Although an electron can sometimes behave as if it were a compact little partiele, physicists have found that *it literally possesses no dimension.* This is difficult for most of us to imagine because everything at our own level of existence possesses dimension. And yet if you try to measure the width of an electron, you will discover it's an impossible task. An electron is simply not an object as we know it.

Another discovery physicists made is that an electron can manifest as either a particle or a wave. If you shoot an electron at the screen of a television that's been turned off, a tiny point of light will appear when it strikes the phosphorescent chemicals that coat the glass. The single point of impact the electron leaves on the screen clearly reveals the particlelike side of its nature.

But this is not the only form the electron can assume. It can also dissolve into a blurry cloud of energy and behave as if it were a wave spread out over space. When an electron manifests as a wave it can do things no particle can. If it is fired at a barrier in which two slits have been cut, it can go through both slits simultaneously. When wavelike electrons collide with each other they even create interference patterns. The electron, like some shapeshifterout of folklore, can manifest as either a particle or a wave.

This chameleonlike ability is common to all subatomic particles. It is also common to all things once thought to manifest exclusively as waves. Light, gamma rays, radio waves, X rays—all can change from waves to particles and back again. Today physicists believe that sub-

atomic phenomena should not be classified solely as either waves or particles, but as a single category of somethings that are always somehow both. These somethings are called *quanta,* and physicists believe they are the basic stuff from which the entire universe is made.*

Perhaps most astonishing of all is that there is compelling evidence that *the only time quanta ever manifest as particles is when we are looking at them.* For instance, when an electron isn't being looked at, experimental findings suggest that it is always a wave. Physicists are able to draw this conclusion because they have devised clever strategies for deducing how an electron behaves when it is not being observed (it should be noted that this is only one interpretation of the evidence and is not the conclusion of all physicists; as we will see, Bohm himself has a different interpretation).

Once again this seems more like magic than the kind of behavior we are accustomed to expect from the natural world. Imagine owning a bowling ball that was only a bowling ball when you looked at it. If you sprinkled talcum powder all over a bowling lane and rolled such a "quantum" bowling ball toward the pins, it would trace a single line through the talcum powder while you were watching it. But if you blinked while it was in transit, you would find that for the second or two you were not looking at it the bowling bail stopped tracing a line and instead left a broad wavy strip, like the undulating swath of a desert snake as it moves sideways over the sand (see fig. 7),

Such a situation is comparable to the one quantum physicists encountered when they first uncovered evidence that quanta coalesce into particles only when they are being observed. Physicist Nick Herbert, a supporter of this interpretation, says this has sometimes caused him to imagine that behind his back the world is always "a radically ambiguous and ceaselessly flowing quantum soup." But whenever he turns around and tries to see the soup, his glance instantly freezes it and turns it back into ordinary reality. He believes this makes us all a little like Midas, the legendary king who never knew the feel of silk or the caress of a human hand because everything he touched turned to gold. "Likewise humans can never experience the true texture of quantum reality," says Herbert, "because everything we touch turns to matter."[2]

^*Quanta,* is the plum! of *quantum.* One electron is a quantum. Several electrons aft a group of quanta. The word *quantum* is also synonymous with *wave particle,* a term that is also used to refer to something that possesses both particle and wave aspects.

Bohm and Interconnectedness

An aspect of quantum reality that Bohm found especially interesting was the strange state of interconnectedness that seemed to exist between apparently unrelated subatomic events. What was equally perplexing was that most physicists tended to attach little importance to the phenomenon. In fact, so little was made of it that one of the most famous examples of interconnectedness lay hidden in one of quantum physics's basic assumptions for a number of years before anyone noticed it was there.

That assumption was made by one of the founding fathers of quantum physics, the Danish physicist Niels Bohr. Bohr pointed out that if subatomic particles only come into existence in the presence of an observer, then it is also meaningless to speak of a particle's properties and characteristics as existing before they are observed. This was disturbing to many physicists, for much of science was based on discovering the properties of phenomena. But if the act of observation actually helped create such properties, what did that imply about the future of science?

One physicist who was troubled by Bohr's assertions was Einstein. Despite the role Einstein had played in the founding of quantum theory, he was not at all happy with the course the fledgling science

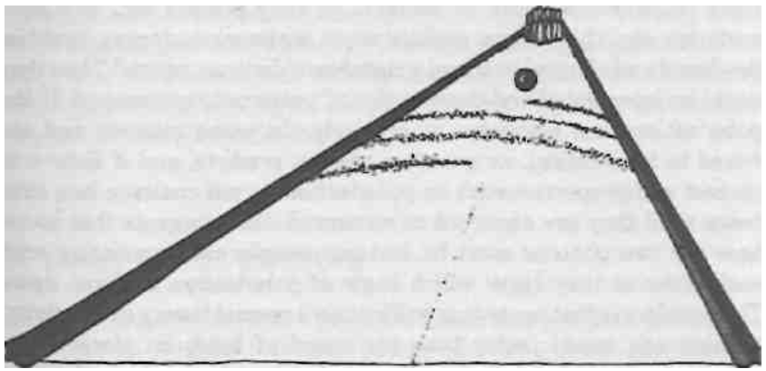


FIGURE 7. Physicists have found compelling evidence that the only time electrons and other "quanta" manifest as particles is when we are looking at them. At all other times they behave as waves. This is as strange as owning a bowling ball that traces a single line down the lane while you are watching it, but leaves a wave pattern every time you blink your eyes.

had taken. He found Bohr's conclusion that a particle's properties don't exist until they are observed particularly objectionable because, when combined with another of quantum physics's findings, it implied that subatomic particles were interconnected in a way Einstein simply didn't believe was possible.

That finding was the discovery that some subatomic processes result in the creation of a pair of particles with identical or closely related properties. Consider an extremely unstable atom physicists call positronium. The positronium atom is composed of an electron and a positron {a positron is an electron with a positive charge). Because a positron is the electron's antiparticle opposite, the two eventually annihilate each other and decay into two quanta of light or "photons" traveling in opposite directions (the capacity to shapeshift from one kind of particle to another is just another of a quantum's abilities). According to quantum physics no matter how far apart the photons travel, when they are measured they will always be found to have identical angles of -*polarization.* (Polarization is the spatial orientation of the photon's wavelike aspect as it travels away from its point of origin.)

In 1935 Einstein and his colleagues Boris Podolsky and Nathan Rosen published a now famous paper entitled "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?" In it they explained why the existence of such twin particles proved that Bohr could not possibly be correct. As they pointed out, two such particles, say, the photons emitted when positronium decays, could be produced and allowed to travel a significant distance apart* Then they could be intercepted and their angles of polarization measured. If the polarizations are measured at precisely the same moment and are found to be identical, as quantum physics predicts, and if Bohr was correct and properties such as polarization do not coalesce into existence until they are observed or measured, this suggests that somehow the two photons must be instantaneously communicating with each other so they know which angle of polarization to agree upon. The problem is that according to Einstein's special theory of relativity, nothing can travel faster than the speed of light, let alone travel instantaneously, for that would be tantamount to breaking the time

•Positrtpnintn decay is not the subatomic process Einstein and his colleagues employed in their thought experiment, but » used here because it is easy to visualize.

barrier and would open the door on all kinds of unacceptable paradoxes. Einstein and his colleagues were convinced that no "reasonable definition" of reality would permit such faster-than-light interconnections to exist, and therefore Bohr had to be wrong.[3] Their argument is now known as the Einstein-Podolsky-Rosen paradox, or EPR paradox for short.

Bohr remained unperturbed by Einstein's argument. Rather than believing that some kind of faster-than-light communication was taking place, he offered another explanation. If subatomic particles do not exist until they are observed, then one could no longer think of them as independent "things." Thus Einstein was basing his argument on an error when he viewed twin particles as separate. They were part of an indivisible system, and it was meaningless to think of them otherwise.

In time most physicists sided with Bohr and became content that his interpretation was correct. One factor that contributed to Bohr's triumph was that quantum physics had proved so spectacularly successful in predicting phenomena, few physicists were willing even to consider the possibility that it might be faulty in some way. In addition, when Einstein and his colleagues first made their proposal about twin particles, technical and other reasons prevented such an experiment from actually being performed. This made it even easier to put out of mind. This was curious, for although Bohr had designed his argument to counter Einstein's attack on quantum theory, as we will see, Bohr's view that subatomic systems are indivisible has equally profound implications for the nature of reality. Ironically, these implications were also ignored, and once again the potential importance of interconnect-edness was swept under the carpet.

A Living Sea of Electrons

During his early years as a physicist Bohm also accepted Bohr's position, but he remained puzzled by the lack of interest Bohr and his followers displayed toward interconnectedness. After graduating from Pennsylvania State College, he attended the University of California at Berkeley, and before receiving his doctorate there in 1943, he worked at the Lawrence Berkeley Radiation Laboratory. There he

encountered another striking example of quantum interconnectedness.

At the Berkeley Radiation Laboratory Bohm began what was to become his landmark work on plasmas. A plasma is a gas containing a high density of electrons and positive ions, atoms that have a positive charge. To his amazement he found that once they were in a plasma, electrons stopped behaving like individuals and started behaving as if they were part of a larger and interconnected whole. Although their individual movements appeared random, vast numbers of electrons were able to produce effects that were surprisingly well-organized. Like some amoeboid creature, the plasma constantly regenerated itself and enclosed all impurities in a wall in the same way that a biological organism might encase a foreign substance in a cyst." So struck was Bohm by these organic qualities that be later remarked he'd frequently had the impression the electron sea was "alive."[3]

In 1947 Bohm accepted an assistant professorship at Princeton University, an indication of how highly he was regarded, and there he extended his Berkeley research to the study of electrons in metals. Once again he found that the seemingly haphazard movements of individual electrons managed to produce highly organized overall effects. Like the plasmas he had studied at Berkeley, these were no longer situations involving two particles, each behaving as if it knew what the other was doing, but entire oceans of particles, each behaving as if it knew what untold trillions of others were doing. Bohm called such collective movements of electrons *plasmons,* and their discovery established his reputation as a physicist.

Bohm's Disillusionment

Both his sense of the importance of interconnectedness as well as his growing dissatisfaction with several of the other prevailing views in physics caused Bohm to become increasingly troubled by Bohr's interpretation of quantum theory. After three years of teaching the subject at Princeton he decided to improve his understanding by writing a textbook. When he finished he found he still wasn't comfortable with what quantum physics was saying and sent copies of the book to both Bohr and Einstein to ask for their opinions. He got no answer from Bohr, but Einstein contacted him and said that since

they were both at Princeton they should meet and discuss the book. In the first of what was to turn into a six-month series of spirited conversations, Einstein enthusiastically told Bohm that he had never seen quantum theory presented so clearly. Nonetheless, he admitted he was still every bit as dissatisfied with the theory as was Bohm. During their conversations the two men discovered they each had nothing but admiration for the theory's ability to predict phenomena. What bothered them was that it provided no real way of conceiving of the basic structure of the world. Bohr and his followers also claimed that quantum theory was complete and it was not possible to arrive at any clearer understanding of what was going on in the quantum realm. This was the same as saying there was no deeper reality beyond the subatomic landscape, no further answers to be found, and this, too, grated on both Bohm and Einstein's philosophical sensibilities. Over the course of their meetings they discussed many other tilings, but these points in particular gained new prominence in Bohm's thoughts. Inspired by his interactions with Einstein, he accepted the validity of his misgivings about quantum physics and decided there .had to be an alternative view. When his textbook *Quantum Theory* was published in 1951 it was hailed as a classic, but it was a classic about a subject to which Bohm no longer gave his full allegiance. His mind, ever active and always looking for deeper explanations, was already searching for a better way of describing reality.

A New Kind of Field and the Bullet That Killed Lincoln

After his talks with Einstein, Bohm tried to find a workable alternative to Bohr's interpretation. He began by assuming that particles such as electrons *do* exist in the absence of observers. He also assumed that there was a deeper reality beneath Bohr's inviolable wall, a subquan-turn level that still awaited discovery by science. Building on these premises he discovered that simply by proposing the existence of a new kind of field on this subquantum level he was able to explain the findings of quantum physics as well as Bohr could. Bohm called his proposed new field the *quantum potential* and theorized that, like gravity, it pervaded all of space. However, unlike gravitational fields,

magnetic fields, and so on, its influence did not diminish with distance. Its effects were subtle, but it was equally powerful everywhere. Bohm published his alternative interpretation of quantum theory in 1952.

Reaction to his new approach was mainly negative. Some physicists were so convinced such alternatives were impossible that they dismissed his ideas out of hand. Others launched passionate attacks against his reasoning. In the end virtually all such arguments were based primarily on philosophical differences, but it did not matter. Bohr's point of view had become so entrenched in physics that Bohm's alternative was looked upon as little more than heresy.

Despite the harshness of these attacks Bohm remained unswerving in his conviction that there was more to reality than Bohr's view allowed. He also felt that science was much too limited in its outlook when it came to assessing new ideas such as his own, and b a 1957 book entitled *Causality and Chance in Modern Physics,* he examined several of the philosophical suppositions responsible for this attitude. One was the widely held assumption that it was possible for any single theory, such as quantum theory, to *be* complete. Bohm criticized this assumption by pointing out that nature may be infinite. Because it would not be possible for any theory to completely explain something that is infinite, Bohm suggested that open scientific inquiry might be better served if researchers refrained from making this assumption.

In the book he argued that the way science viewed causality was also much too limited. Most effects were thought of as having only one or several causes. However, Bohm felt that an effect could have an infinite number of causes. For example, if you asked someone what caused Abraham Lincoln's death, they might answer that it was the bullet in John Wilkes Booth's gun. But a complete list of all the causes that contributed to Lincoln's death would have to include all of the events that led to the development of the gun, all of the factors that caused Booth to want to kill Lincoln, all of the steps in the evolution of the human race that allowed for the development of a hand capable of holding a gun, and so on, and so on. Bohm conceded that most of the time one could ignore the vast cascade of causes that had led to any given effect, but he still felt it was important for scientists to remember that no single cause-and-effect relationship was ever really separate from the universe as a whole.

If You Want to Know Where You Are, Ask the Nonlocals

During this same period of his life Bohm also continued to refine his alternative approach to quantum physics. As he looked more carefully into the meaning of the quantum potential he discovered it had a number of features that implied an even more radical departure from orthodox thinking. One was the importance of wholeness. Classical science had always viewed the state of a system as a whole as merely the result of the interaction of its parts. However, the quantum potential stood this view on its ear and indicated that the behavior of the parts was actually organized by the whole. This not only took Bohr's assertion that subatomic particles are not independent "things," but are part of an indivisible system one step further, but even suggested that wholeness was in some ways the more primary reality.

It also explained how electrons in plasmas (and other specialized states such as superconductivity) could behave like interconnected wholes. As Bohm states, such "electrons are not scattered because, through the action of the quantum potential, the whole system is undergoing a co-ordinated movement more like a ballet dance than like a crowd of unorganized people." Once again he notes that "such quantum wholeness of activity is closer to the organized unity of functioning of the parts of a living being than it is to the kind of unity that is obtained by putting together the parts of a machine."[8]

An even more surprising feature of the quantum potential was its implications for the nature of location. At the level of our everyday lives things have very specific locations, but Bohm's interpretation of quantum physics indicated that at the subquantum level, the level in which the quantum potential operated, location ceased to exist. All points in space became equal to all other points in space, and it was meaningless to speak of anything as being separate from anything else. Physicists call this property "n on locality."

The nonlocal aspect of the quantum potential enabled Bohm to explain the connection between twin particles without violating special relativity's ban against anything traveling faster than the speed of light. To illustrate how, he offers the following analogy: Imagine a fish swimming in an aquarium. Imagine also that you have never seen a fish or an aquarium before and your only knowledge about them comes from two television cameras, one directed at the aquarium's

front and the other at its side. When you look at the two television monitors you might mistakenly assume that the fish on the screens are separate entities. After all, because the cameras are set at different angles, each of the images will be slightly different. But as you continue to watch you will eventually realize there is a relationship between the two fish. When one turns, the other makes a slightly different but corresponding turn. When one faces the front, the other faces the side, and so on. If you are unaware of tile full scope of the situation, you might wrongly conclude that the fish are instantaneously communicating with one another, but this is not the case. No communication is taking place because at a deeper level of reality, the reality of the aquarium, the two fish are actually one and the same. This, says Bohm, is precisely what is going on between particles such as the two photons emitted when a positronium atom decays (see fig. 8). Indeed, because the quantum potential permeates all of space, all

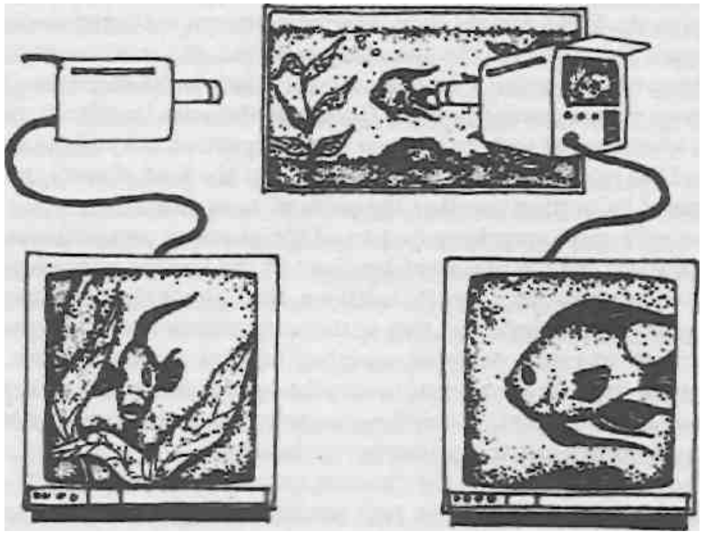


FIGURE 8. Bohm believes subatomic particles are connected in the same way as the images of the fish on the two television monitors. Although particles such as electrons appear to be separate from one another, on a deeper level of reality—a level analogous to the aquarium—they are actually just different aspects of a deeper cosmic unity.

particles are nonlocally interconnected. More and more the picture of reality Bohm was developing was not one in which subatomic particles were separate from one another and moving through the void of space, but one in which all things were part of an unbroken web and embedded in a space that was as real and rich with process as the matter that moved through it.

Bohm's ideas still left most physicists unpersuaded, but did stir the interest of a few. One of these was John Stewart Bell, a theoretical physicist at CERN, a center for peaceful atomic research near Geneva, Switzerland. Like Bohm, Bell had also become discontented with quantum theory and felt there must be some alternative. As he later said, "Then in 1952 I saw Bohm's paper. His idea was to complete quantum mechanics by saying there are certain variables in addition to those which everybody knew about. That impressed me very much."[1]

Bell also realized that Bohm's theory implied the existence of nonlo-catity and wondered if there was any way of experimentally verifying its existence. The question remained in the back of his mind for years until a sabbatical in 1964 provided him with the freedom to focus his full attention on the matter. Then he quickly came up with an elegant mathematical proof that revealed how such an experiment could be performed. The only problem was that it required a level of technological precision that was not yet available. To be certain that particles, such as those in the EPR paradox, were not using some normal means of communication, the basic operations of the experiment had to be performed in such an in finite simally brief instant that there wouldn't even be enough time for a ray of light to cross the distance separating the two particles. This meant that the instruments used in the experiment had to perform all of the necessary operations within a few thousand-millionths of a second.

Enter the Hologram

By the late 1950s Bohm had already had his run-in with MeCarthyism and had become a research fellow at Bristol University, England. There, along with a young research student named Yakir Aharonov, he discovered another important example of nonlocal interconnected-ness. Bohm and Aharonov found that under the right circumstances an electron is able to "feel" the presence of a magnetic field that is in

a region where there is zero probability of finding the electron. This phenomenon is now known as the Aharonov-Bohm effect, and when the two men first published their discovery, many physicists did not believe such an effect was possible. Even today there is enough residual skepticism that, despite confirmation of the effect in numerous experiments, occasionally papers still appear arguing that it doesn't exist.

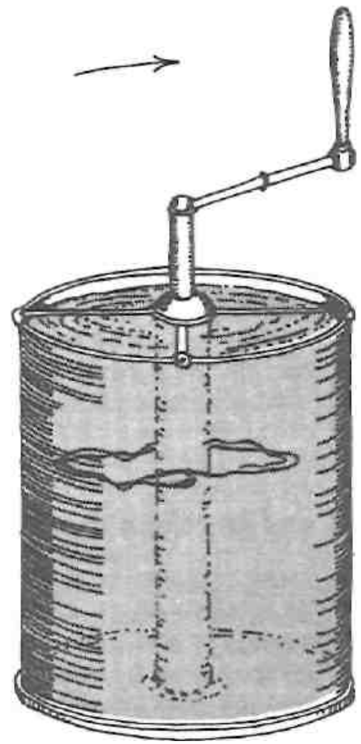
As always, Bohm stoically accepted his continuing role as the voice in the crowd that bravely notes the emperor has no clothes. In an interview conducted some years later he offered a simple summation of the philosophy underlying his courage: "In the long run it is far more dangerous to adhere to illusion than to face what the actual fact is."[8]

Nevertheless, the limited response to his ideas about wholeness and nonlocality and his own inability to see how to proceed further caused him to focus his attention in other directions. In the 1960s this led him to take a closer look at *order.* Classical science generally divides things into two categories: those that possess order in the arrangement of their parts and those whose parts are disordered, or random, in arrangement. Snowfiakes, computers, and living things are all ordered. The pattern a handful of spilled coffee beans makes on the floor, the debris left by an explosion, and a series of numbers generated by a roulette wheel are all disordered.

As Eohm delved more deeply into the matter he realized there were also different degrees of order. Some things were much more ordered than other things, and this implied that there was, perhaps, no end to the hierarchies of order that existed in the universe. From this it occurred to Eohm that maybe things that we perceive as disordered aren't disordered at all. Perhaps their order is of such an "indefinitely high degree" that they only appear to us as random (interestingly, mathematicians are unable to prove randomness, and although some sequences of numbers are categorized as random, these are only educated guesses).

While immersed in these thoughts, Bohm saw a device on a BBC television program that helped him develop his ideas even further. The device was a specially designed jar containing a large rotating cylinder. The narrow space between the cylinder and the jar was filled with glycerine—a thick, clear liquid—and floating motionlessly in the glycerine was a drop of ink. What interested Bohm was that when the handle on the cylinder was turned, the drop of ink spread out through

the syrupy glycerine and seemed to disappear. But as soon as the handle was turned back in the opposite direction, the faint tracing of ink slowiy collapsed upon itself and once again formed a droplet (see fig. 9)-Bohm writes, "This immediately struck me as very relevant to the question of order, since, when the ink drop was spread out, it still had a 'hidden' {i.e., nonmanifest) order that was revealed when it was reconstituted. On the other hand, in our usual language, we would say that the ink was in a state of 'disorder* when it was diffused through the glycerine. This led me to see that new notions of order must be involved here."[9]



FIC-URE 9, When a drop of ink is placed in a jar full of glycerine and a cylinder inside the jar is turned, the drop appears to spread out and disappear. But when the cylinder is turned in the opposite direction, the drop comes back together. Eohm uses this phenomenon as an example of how order can be either manifest (explicit) or hidden (implicit).

This discovery excited Bohm greatly, for it provided him with a new way of looking at many of the problems he had been contemplating. Soon after coming across the ink-in-g]ycerine device he encountered an even better metaphor for understanding order, one that enabled him not only to bring together all the various strands of his years of thinking, but did so with such force and explanatory power it seemed almost tailor-made for the purpose. That metaphor was the hologram.

As soon as Bohm began to reflect on the hologram he saw that it *too* provided a new way of understanding order. Lake the ink drop in its dispersed state, the bterference patterns recorded on a piece of holographic film also appear disordered to the naked eye. Both possess orders that are hidden or *enfolded* in much the same way that the order in a plasma is enfolded in the seemingly random behavior of each of its electrons. But this was not the only insight the hologram provided.

The more Bohm thought about it the more convinced he became that the universe actually employed holographic principles in its operations, *was itself a kind of giant, flowing hologram,* and this realization allowed him to crystallize all of his various insights into a sweeping and cohesive whole. He published his first papers on his holographic view of the universe in the early 1970s, and in 1980 he presented a mature distillation of his thoughts in a book entitled *Wholeness and the Implicate Order.* In it he did more than just link his myriad ideas together. He transfigured them into a new way of looking at reality that was as breathtaking as it was radical.

Enfolded Orders and Unfolded Realities

One of Bohm's most startling assertions is that the tangible reality of our everyday lives is really a kind of illusion, like a holographic image. Underlying it is a deeper order of existence, a vast and more primary level of reality that gives birth to all the objects and appearances of our physical world in much the same way that a piece of holographic film gives birth to a hologram. Bohm calls this deeper level of reality the *implicate* (which means "enfolded") order, and he refers to our own level of existence as the *explicate,* or unfolded, order. He uses these terms because he sees the manifestation of all forms

in the universe as the result of countless enfoldings and unfoldings between these two orders. For example, Bohm believes an electron is not one thing but a totality or ensemble enfolded throughout the whole of space. When an instrument detects the presence of a single electron it is simply because one aspect of the electron's ensemble has unfolded, similar to the way an ink drop unfolds out of the glycerine, at that particular location. When an electron appears to be moving it is due to a continuous series of such unfoldments and enfoldments.

Put another way, electrons and all other particles are no more substantive or permanent than the form a geyser of water takes as it gushes out of a fountain. They are sustained by a constant influx from the implicate order, and when a particle appears to be destroyed, it is not lost. It has merely enfolded back into the deeper order from which it sprang. A piece of holographic film and the image it generates are also an example of an implicate and explicate order. The film is an implicate order because the image encoded in its interference patterns is a hidden totality enfolded throughout the whole. The hologram projected from the film is an explicate order because it represents the unfolded and perceptible version of the image.

The constant and flowing exchange between the two orders explains how particles, such as the electron in the positronium atom, can shape-shift from one kind of particle to another. Such shiftings can be viewed as one particle, say an electron, enfolding back into the implicate order while another, a photon, unfolds and takes its place. It also explains how a quantum can manifest as either a particle or a wave. According to Bohm, both aspects are always enfolded in a quantum's ensemble, but the way an observer interacts with the ensemble determines which aspect unfolds and which remains hidden. As such, the role an observer plays in determining the form a quantum takes may be no more mysterious than the fact that the way a jeweler manipulates a gem determines which of its facets become visible and which do not. Because the term *hologram* usually refers to an image that is static and does not convey the dynamic and ever active nature of the incalculable enfoldings and unfoldings that moment by moment create our universe, Bohm prefers to describe the universe not as a hologram, but as a "holomovement."

The existence of a deeper and holographically organized order also explains why reality becomes nonlocal at the subquantum level. As we have seen, when something is organized holographically, all sem-

blance of location breaks down. Saying that every part of a piece of holographic film contains all the information possessed by the whole is really just another way of saying that the information is distributed nonlocally. Hence, if the universe is organized according to holographic principles, it, too, would be expected to have nonlocal properties.

The Undivided Wholeness of All Things

Most mind-boggling of all are Bohm's fully developed ideas about wholeness. Because everything in the cosmos is made out of the seamless holographic fabric of the implicate order, he believes it is as meaningless to view the universe as composed of "parts," as it is to view the different geysers in a fountain as separate from the water out of which they flow. An electron is not an "elementary particle." It is just a name given to a certain aspect of the holomovement. Dividing reality up into parts and then naming those parts is always arbitrary, a product of convention, because subatomic particles, and everything else in the universe, are no more separate from one another than different patterns in an ornate carpet.

This is a profound suggestion. In his general theory of relativity Einstein astounded the world when he said that space and time are not separate entities, but are smoothly linked and part of a larger whole he called the space-time continuum. Bohm takes this idea a giant step further. He says that *everything* in the universe is part of a continuum. Despite the apparent separateness of things at the explicate level, everything is a seamless extension of everything else, and ultimately even the implicate and explicate orders blend into each other.

Take a moment to consider this. Look at your hand. Now look at the light streaming from the lamp beside you. And at the dog resting at your feet. You are not merely made of the same things. *You are the same thing.* One thing. Unbroken. One enormous something that has extended its uncountable arms and appendages into all the apparent objects, atoms, restless oceans, and twinkling stars in the cosmos.

Bohm cautions that this does not mean the universe is a giant undifferentiated mass. Things can be part of an undivided whole and still possess their own unique qualities. To illustrate what he means he

points to the little eddies and whirlpools that often form in a river. At a glance such eddies appear to be separate things and possess many individual characteristics such as size, rate, and direction of rotation, et cetera. But careful scrutiny reveals that it is impossible to determine where any given whirlpool ends and the river begins. Thus, Bohm is not suggesting that the differences between "things" is meaningless. He merely wants us to be aware constantly that dividing various aspects of the holomovement into "things" is always an abstraction, a way of making those aspects stand out in our perception by our way of thinking. In attempts to correct this, instead of calling different aspects of the holomovement "things," he prefers to call them "relatively independent subtotalities."[10]

Indeed, Bohm believes that our almost universal tendency to fragment the world and ignore the dynamic interconnectedness of all things is responsible for many of our problems, not only in science but in our lives and our society as well. For instance, we believe we can extract the valuable parts of the earth without affecting the whole. We believe it is possible to treat parts of our body and not be concerned with the whole. We believe we can deal with various problems in our society, such as crime, poverty, and drug addiction, without addressing the problems in our society as a whole, and so on. In his writings Bohm argues passionately that our current way of fragmenting the world into parts not only doesn't work, but may even lead to our extinction.

Consciousness as a More Subtle Form of Matter

In addition to explaining why quantum physicists find so many examples of interconnectedness when they plumb the depths of matter, Bohm's holographic universe explains many other puzzles. One is the effect consciousness seems to have on the subatomic world. As we have seen, Bohm rejects the idea that particles don't exist until they are observed. But he is not in principle against trying to bring consciousness and physics together. He simply feels that most physicists go about it the wrong way, by once again trying to fragment reality and saying that one separate thing, consciousness, interacts with another separate thing, a subatomic particle.

Because all such things are aspects of the holomovement, he feels it has no meaning to speak of consciousness and matter as interacting. In a sense, the observer *is* the observed. The observer is aJso the measuring device, the experimental results, the laboratory, and the breeze that blows outside the laboratory. In fact, Bohm believes that consciousness is a more subtle form of matter, and the basis for any relationship between the two lies not in our own level of reality, but deep in the implicate order. Consciousness is present in various degrees of enfoidment and unfoldment in all matter, which is perhaps why plasmas possess some of the traits of living things. As Bohm puts it, "The ability of form to be active is the most characteristic feature of mind, and we have something that is mindlike already with the electron."[11]

Similarly, he believes that dividing the universe up into living and nonliving things also has no meaning. Animate and inanimate matter are inseparably interwoven, and life, too, is enfolded throughout the totality of the universe. Even a rock is in some way alive, says Bohm, for life and intelligence are present not only in all of matter, but in "energy," "space," "time," "the fabric of the entire universe," and everything else we abstract out of the holomovement and mistakenly view as separate things.

The idea that consciousness and life (and indeed all things) are ensembles enfolded throughout the universe has an equally dazzling flip side. Just as every portion of a hologram contains the image of the whole, every portion of the universe enfolds the whole. This means that if we knew how to access it we could find the Andromeda galaxy in the thumbnail of our left hand. We could also find Cleopatra meeting Caesar for the first time, for in principle the whole past and implications for the whole future are also enfolded in each small region of space and time. Every cell in our body enfolds the entire cosmos. So does every leaf, every raindrop, and every dust mote, which gives new meaning to William Blake's famous poem:

> *To see a World in a Grain of Sand And a Heaven in a Wild Flower, Hold Infinity in the palm of your hand And Eternity in an hour.*

The Energy of a Trillion Atomic Bombs in Every Cubic Centimeter of Space

If our universe is only a pale shadow of a deeper order, what else lies hidden, enfolded in the warp and weft of our reality? Bohm has a suggestion. According to our current understanding of physics, every region of space is awash with different kinds of fields composed of waves of varying lengths. Each wave always has at least some energy. When physicists calculate the minimum amount of energy a wave can possess, they find that *every cubic centimeter of empty space contains more energy than the total energy of all the matter in the known universe!*

Some physicists refuse to take this calculation seriously and believe it must somehow be in error. Bohm thinks this infinite ocean of energy does exist and tells us at least a little about the vast and hidden nature of the implicate order. He feels most physicists ignore the existence of this enormous ocean of energy because, like fish who are unaware of the water in which they swim, they have been taught to focus primarily on objects embedded in the ocean, on matter.

Bohm's view that space is as real and rich with process as the matter that moves through it reaches full maturity in his ideas about the implicate sea of energy. Matter does not exist independently from the sea, from so-called empty space. It is a part of space. To explain what he means, Bohm offers the following analogy: A crystal cooled to absolute zero will allow a stream of electrons to pass through it without scattering them. If the temperature is raised, various flaws in the crystal will lose their transparency, so to speak, and begin to scatter electrons. Prom an electron's point of view such flaws would appear as pieces of "matter" floating in a sea of nothingness, but this is not really the case. The nothingness and the pieces of matter do not exist independently from one another. They are both part of the same fabric, the deeper order of the crystal.

Bohm believes the same is true at our own level of existence. Space is not empty. It *is full,* a plenum as opposed to a vacuum, and is the ground for the existence of everything, including ourselves. The universe is not separate from this cosmic sea of energy, it is a ripple on its surface, a comparatively small "pattern of excitation" in the midst of an unimaginably vast ocean. "This excitation pattern is relatively autonomous and gives rise to approximately recurrent, stable and

separable projections into a three-dimensional explicate order of manifestation/' states Bohm.[lz] In other words, despite its apparent materiality and enormous size, the universe does not exist in and of itself, but is the stepchild of something far vaster and more ineffable. More than that, it is not even a major production of this vaster something, but is only a passing shadow, a mere hiccup in the greater scheme of things.

This infinite sea of energy is not all that is enfolded in the implicate order. Because the implicate order is the foundation that has given birth to everything in our universe, at the very least it also contains every subatomic particle that has been or will be; every configuration of matter, energy, life, and consciousness that is possible, from quasars to the brain of Shakespeare, from the double helix, to the forces that control the sizes and shapes of galaxies. And even this is not all it may contain. Bohm concedes that there is no reason to believe the implicate order is the end of things. There may be other undreamed of orders beyond it, infinite stages of further development.

Experimental Support for Bohm's Holographic Universe

A number of tantalizing findings in physics suggest that Bohm may be correct. Even disregarding the implicate sea of energy, space is filled with light and other electromagnetic waves that constantly crisscross and interfere with one another. As we have seen, all particles are also waves. This means that physical objects and everything else we perceive in reality are composed of interference patterns, a fact that has undeniable holographic implications.

Another compelling piece of evidence comes from a recent experimental finding. In the 1970s the technology became available to actually perform the two-particle experiment outlined by Bell, and a number of different researchers attempted the task. Although the findings were promising, none was able to produce conclusive results. Then in 1982 physicists Alain Aspect, Jean Dalibard and Gerard Roger of the Institute of Optics at the University of Paris succeeded. First they produced a series of twin photons by heating calcium atoms with lasers. Then they allowed each photon to travel in opposite directions

through 6.5 meters of pipe and pass through special filters that directed them toward one of two possible polarization analyzers. It took each filter 10 billionths of a second to switch between one analyzer or the other, about 30 billionths of a second less than it took for light to travel the entire 13 meters separating each set of photons. In this way Aspect and his colleagues were able to rule out any possibility of the photons communicating through any known physical process.

Aspect and his team discovered that, as quantum theory predicted, each photon was still able to correlate its angle of polarization with that of its twin. This meant that either Einstein's ban against faster-than-light communication was being violated, or the two photons were nonlocally connected. Because most physicists are opposed to admitting faster-than-light processes into physics, Aspect's experiment is generally viewed as virtual proof that the connection between the two photons is nonlocal. Furthermore, as physicist Paul Davis of the University of Newcastle upon Tyne, England, observes, since *all* particles are continually interacting and separating, "the nonlocal aspects of quantum systems is therefore a general property of nature."[13]

Aspect's findings do not prove that Bohm's model of the universe is correct, but they do provide it with tremendous support. Indeed, as mentioned, Bohm does not believe any theory is correct in an absolute sense, including his own. All are only approximations of the truth, finite maps we use to try to chart territory that is both infinite and indivisible. This does not mean he feels his theory is not testable. He is confident that at some point in the future techniques will be developed which will allow his ideas to be tested (when Bohm is criticized on this point he notes that there are a number of theories in physics, such as "superstring theory," which will probably not be testable for several decades).

The Reaction of the Physics Community

Most physicists are skeptical of Bohm's ideas. For example, Yale physicist Lee Smolin simply does not find Bohm's theory "very compelling, physically."[1]" Nonetheless, there is an almost universal respect for Bohm's intelligence. The opinion of Boston University physicist Abner Shimony is representative of this view. "I'm afraid I just don't understand his theory. It is certainly a metaphor and the question is how

literally to take the metaphor. StiH, he has really thought very deeply about the matter and 1 think he's done a tremendous service by bringing these questions to the forefront of physics's research instead of just having them swept under the rug. He's been a courageous, daring, and imaginative man."[15]

Such skepticism notwithstanding, there are also physicists who are sympathetic to Bohm's ideas, including such big guns as Roger Penrose of Oxford, the creator of the modern theory of the black hole; Bernard d'Espagnat of the University of Paris, one of the world's leading authorities on the conceptual foundations of quantum theory; and Cambridge's Brian Josephson, winner of the 1973 Nobel Prize in physics. Josephson believes Bohm's implicate order may someday even lead to the inclusion of God or Mind within the framework of science, an idea Josephson supports.[16]

Pribram and Bohm Together

Considered together, Bohm and Pribram's theories provide a profound new way of looking at the world: *Our brains mathematically construct objective reality by interpreting frequencies that are ultimately projections from another dimension, a deeper order of existence that is beyond both space and time: The brain is a hologram enfolded in a holographic universe.*

For Pribram, this synthesis made him realize that the objective world does not exist, at least not in the way we are accustomed to believing. What is "out there" is a vast ocean of waves and frequencies, and reality looks concrete to us only because our brains are able to take this holographic blur and convert it into the sticks and stones and other familiar objects that make up our world. How is the brain (which itself is composed of frequencies of matter) able to take something as insubstantial as a blur of frequencies and make it seem solid to the touch? "The kind of mathematical process that Bekesy simulated with his vibrators is basic to how our brains construct our image of a world out there," Pribram states.[17] In other words, the smoothness of a piece of fine china and the feel of beach sand beneath our feet are really just elaborate versions of the phantom bmb syndrome.

According to Pribram this does not mean there aren't china cups and grains of beach sand out there. It simply means that a china cup has two very different aspects to its reality. When it is filtered through the lens of our brain it manifests as a cup. But if we could get rid of our lenses, we'd experience it as an interference pattern. Which one is real and which is illusion? "Both are real to me," says Pribram, "or, if you want to say, neither of them are real."'[8]

This state of affairs is not limited to china cups. We, too, have two very different aspects to our reality. We ean view ourselves as physical bodies moving through space. Or we can view ourselves as a blur of interference patterns enfolded throughout the cosmic hologram. Bohm believes this second point of view might even be the more correct, for to think of ourselves as a holographic mind/brain *looking* at a holographic universe is again an abstraction, an attempt to separate two things that ultimately cannot be separated.[13]

Do not be troubled if this is difficult to grasp. It is relatively easy to understand the idea of holism in something that is external to us, like an apple in a hologram. What makes it difficult is that in this case we are not looking at the hologram. We are part of the hologram.

The difficulty is also another indication of how radical a revision Bohm and Pribram are trying to make in our way of thinking. But it is not the only radical revision. Pribram's assertion that our brains construct objects pales beside another of Bohm's conclusions: *that we even construct space and time.*[20] The implications of this view are just one of the subjects that will be examined as we explore the effect Bohm and Pribram's ideas have had on the work of researchers in other fields.

PART II

MIND AND BODY

If we were to look closely *at an* individual human being, we would immediately notice that it is a unique hologram unto itself; self-contained, self-generating, and self-knowledgeable. Yet if we were to remove this being from its planetary context, we would quickly realize that the human form is not unlike a mnndala or symbolic poem, for within its form and flow lives comprehensive information about various physical, social, psychological, and evolutionary contexts within which it was created.

—Dr. Ken Dychfwald
in The *Holographic* Paradigm
(Ken Wilber, editor]

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The Holographic Model and Psychology

While the traditional model of psychiatry and psychoanalysis is strictly personalistic and biographical, modern consciousness research has added new levels, realms, and dimensions and shows the human psyche as being essentially commensurate with the whole universe and all of existence.

—Stanislav Grof *Beyond the Brain*

One area of research on which the holographic model has had an impact is psychology. This is not surprising, for, as Bohm has pointed out, consciousness itself provides a perfect example of what he means by undivided and flowing movement. The ebb and flow of our consciousness is not precisely definable but can be seen as a deeper and more fundamental reality out of which our thoughts and ideas unfold. In turn, these thoughts and ideas are not unlike the ripples, eddies, and whirlpools that form in a flowing stream, and like the whirlpools in a stream some can recur and persist in a more or less stable way, while others are evanescent and vanish almost as quickly as they appear. The holographic idea also sheds light on the unexplainable linkages that can sometimes occur between the consciousnesses of two or more individuals. One of the most famous examples of such linkage is em-

bodied in Swiss psychiatrist Carl Jung's concept of a collective unconscious. Early in his career Jung became convinced that the dreams, artwork, fantasies, and hallucinations of his patients often contained symbols and ideas that could not be explained entirely as products of their personal history. Instead, such symbols more closely resembled the images and themes of the world's great mythologies and religions. Jung concluded that myths, dreams, hallucinations, and religious visions all spring from the same source, a collective unconscious that is shared by all people.

One experience that led Jung to this conclusion took place in 1906 and involved the hallucination of a young man suffering from paranoid schizophrenia. One day while making his rounds Jung found the young man standing at a window and staring up at the sun. The man was also moving his head from side to side in a curious manner. When Jung asked him what he was doing he explained that he was looking at the sun's penis, and when he moved his head from side to side, the sun's penis moved and caused the wind to blow.

At the time Jung viewed the man's assertion as the product of a hallucination. But several years later he came across a translation of a two-thousand-year-old Persian religious text that changed his mind. The text consisted of a series of rituals and invocations designed to bring on visions. It described one of the visions and said that if the participant looked at the sun he would see a tube hanging down from it, and when the tube moved from side to side it would cause the wind to blow. Since circumstances made it extremely unlikely that the man had had contact with the text containing the ritual, Jung concluded that the man's vision was not simply a product of his unconscious mind, but had bubbled up from a deeper level, from the collective unconscious of the human race itself. Jung called such images *archetypes* and believed they were so ancient it's as if each of us has the memory of a two-million-year-old man lurking somewhere in the depths of our unconscious minds.

Although Jung's concept of a collective unconscious has had an enormous impact on psychology and is now embraced by untold thousands of psychologists and psychiatrists, our current understanding of the universe provides no mechanism for explaining its existence. The interconnectedness of all things predicted by the holographic model, however, does offer an explanation. In a universe in which ail things are infinitely interconnected, all consciousnesses are also interconnected. Despite appearances, we are beings without borders. Or as

Eohm puts it, "Deep down the consciousness of mankind is one."[1]

If each of us has access to the unconscious knowledge of the entire human race, why aren't we all walking encyclopedias? Psychologist Robert M. Anderson, Jr., of the Rensselaer Polytechnic Institute in Troy, New York, believes it is because we are only able to tap into information in the implicate order that is directly relevant to our memories. Anderson calls this selective process *personal resonance* and likens it to the fact that a vibrating tuning fork will resonate with (or set up a vibration in) another tuning fork *only* if the second tuning fork possesses a similar structure, shape, and size, "Due to personal resonance, relatively few of the almost infinite variety of 'images' in the implicate holographic structure of the universe are available to an individual's personal consciousness," says Anderson. "Thus, when enlightened persons glimpsed this unitive consciousness centuries ago, they did not write out relativity theory because they were not studying physics in a context similar to that in which Einstein studied physics."[2]

Dreams and the Holographic Universe

Another researcher who believes Bohm's implicate order has applications in psychology is psychiatrist Montague Uilman, the founder of the Dream Laboratory at the Maimonides Medical Center in Brooklyn, New York, and a professor emeritus of clinical psychiatry at the Albert Einstein College of Medicine, also in New York. Ullman's initial interest in the holographic concept stemmed also from its suggestion that all people are interconnected in the holographic order. He has good reason for his interest Throughout the 1960s and 1970s he was responsible for many of the ESP dream experiments mentioned in the introduction. Even today the ESP dream studies conducted at Maimonides stand as some of the best empirical evidence that, in our dreams at least, we are able to communicate with one another in ways that cannot presently be explained.

In a typical experiment a paid volunteer who claimed to possess no psychic ability was asked to sleep in a room in the lab while a person in another room concentrated on a randomly selected painting and tried to get the volunteer to dream of the image it contained. Sometimes the results were inconclusive. But other times the volunteers bad dreams that were clearly influenced by the paintings. For exam-

pie, when the target painting was Tamayo's *Animals,* a picture depict-ing two dogs flashing their teeth and howling over a pile of bones, the test subject dreamed she was at a banquet where there was not enough meat and everyone was warily eyeing one another as they greedily ate their allotted portions.

In another experiment the target picture was Chagall's *Paris from a Window,* a brightly colored painting depicting a man looking out a window at the Paris skyline. The painting also contained several other unusual features, including a cat with a human face, several small figures of men flying through the air, and a chair covered with flowers. Over the course of several nights the test subject dreamed repeatedly about things French, French architecture, a French policeman's hat, and a man in French attire gazing at various "layers" of a French village. Some of the images in these dreams also appeared to be specific references to the painting's vibrant colors and unusual features, such as the image of a group of bees flying around flowers, and a brightly colored Mardi Gras-type celebration in which the people were wearing costumes and masks.[3]

Although Ullman believes such findings are evidence of the underlying state of interconnectedness Eohm is talking about, he feels that an even more profound example of holographic wholeness can be found in another aspect of dreaming. That is the ability of our dreaming selves often to be far wiser than we ourselves are in our waking state. For instance, Ullman says that in his psychoanalytic practice he could have a patient who seemed completely unenlightened when he was awake—mean, selfish, arrogant, exploitative, and manipulative; a person who had fragmented and dehumanized all of his interpersonal relationships. But no matter how spiritually blind a person may be, or unwilling to recognize his or her own shortcomings, dreams invariably depict their failings honestly and contain metaphors that seem designed to prod him or her gently into a state of greater self-awareness.

Moreover, such dreams were not one-time occurrences. During the course of his practice Ullman noticed that when one of his patients failed to recognize or accept some truth about himself, that truth would surface again and again in his dreams, in different metaphorical guises and linked with different related experiences from his past, but always in an apparent attempt to offer him new opportunities to come to terms with the truth.

Because a man can ignore the counsel of his dreams and still live to be a hundred, Ullman believes this self-monitoring process is striv-

ing for more than just the welfare of the individual. He believes that nature is concerned with the survival of the species. He also agrees with Bohm on the importance of wholeness and feels that dreams are nature's way of faying to counteract our seemingly unending compulsion to fragment the world. "An individual can disconnect from all that's cooperative, meaningful, and loving and still survive, but nations don't have that luxury. Unless we learn how to overcome all the ways we've fragmented the human race, nationally, religiously, economically, or whatever, we are going to continue to find ourselves in a position where we can accidentally destroy the whole picture," says Ullman. "The only way we can do that is to look at how we fragment our existence as individuals. Dreams reflect our individual experience, but I think that's because there's a greater underlying need to preserve the species, to maintain species-connectedness."[4]

What is the source of the unending flow of wisdom that bubbles up in our dreams? Ullman admits that he doesn't know, but he offers a suggestion. Given that the implicate order represents in a sense an infinite information source, perhaps it is the origin of this greater fund Of knowledge. Perhaps dreams are a bridge between the perceptual and nonmanifest orders and represent a "natural transformation of the implicate into the explicate."[6] If Ullman is correct in this supposition it stands the traditional psychoanalytic view of dreams on its ear, for instead of dream content being something that ascends into con-sciousness from a primitive substratum of the personality, quite the opposite would be true.

Psychosis and the Implicate Order

Ullman believes that some aspects of psychosis ean also be explained by the holographic idea. Both Bohm and Pribram have noted that the experiences mystics have reported throughout the ages—such as feel-ings of cosmic oneness with the universe, a sense of unity with all life, and so fortli—sound very much like descriptions of the implicate Order. They suggest that perhaps mystics are somehow able to peer beyond ordinary explicate reality and glimpse its deeper, more holographic qualities. Ullman believes that psychotics are also able to experience certain aspects of the holographic level of reality. But because they are unable to order their experiences rationally, these

glimpses are only tragic parodies of the ones reported by mystics.

For example, schizophrenics often report oceanic feelings of oneness with the universe, but in a magic, delusional way. They describe feeling a loss of boundaries between themselves and others, a belief that leads them to think their thoughts are no longer private. They believe they are able to read the thoughts of others. And instead of viewing- people, objects, and concepts as individual things, they often view them as members of larger and larger subclasses, a tendency that seems to be a way of expressing the holographic quality of the reality in which they find themselves.

Ullman believes that schizophrenics try to convey their sense of unbroken wholeness in the way they view space and time. Studies have shown that schizophrenics often treat the converse of any relation as identical to the relation.[6] For instance, according to the schizophrenic's way of thinking, saying that "event A follows event B" is the same as saying "event B follows event A." The idea of one event following another in any kind of time sequence is meaningless, for all points in time are viewed equal. The same is true of spatial relations. If a man's head is above his shoulders, then his shoulders are also above his head. Like the image in a piece of holographic film, things no longer have precise locations, and spatial relationships cease to have meaning.

Ullman believes that certain aspects of holographic thinking are even more pronounced in manicTdepressives. Whereas the schizophrenic only gets whiffs of the holographic order, the manic is deeply involved in it and grandiosely identifies with its infinite potential. "He can't keep up with all the thoughts and ideas that come at him in so overwhelming a way," states Ullman, "He has to lie, dissemble, and manipulate those about him so as to accommodate to his expansive vista. The end result, of course, is mostly chaos and confusion mixed with occasional outbursts of creativity and success in consensual reality."[7] In turn, the manic becomes depressed after he returns from this surreal vacation and once again faces the hazards and chance occurrences of everyday life.

If it is true that we all encounter aspects of the implicate order when we dream, why don't these encounters have the same effect on us as they do on psychotics? One reason, says Ullman, is that we leave the unique and challenging logic of the dream behind when we wake. Because of his condition the psychotic is forced to contend with it while simultaneously trying to function in everyday reality. Ullman also theorizes that when we dream, most of us have a natural protective mechanism that keeps us from coming into contact with more of the implicate order than we can cope with.

Lucid Dreams and Parallel Universes

In recent years psychologists have become increasingly interested in *lucid dreams,* a type of dream in which the dreamer maintains full waking consciousness and is aware that he or she is dreaming. In addition to the consciousness factor, lucid dreams are unique in several other ways. Unlike normal dreams in which the dreamer is primarily a passive participant, in a lucid dream the dreamer is often able to control the dream in various ways—turn nightmares into pleasant experiences, change the setting of the dream, and/or summon up particular individuals or situations. Lucid dreams are also much more vivid and suffused with vitality than normal dreams. In a lucid dream marble floors seem eerily solid and real, flowers, dazzlingly colorful and fragrant, and everything is vibrant and strangely energized. Researchers studying lucid dreams believe they may lead to new ways to stimulate personal growth, enhance self-confidence, promote mental and physical health, and facilitate creative problem solving.[1]*

At the 1987 annual meeting of the Association for the Study of Dreams held in Washington, D.C., physicist Fred Alan Wolf delivered a talk in which he asserted that the holographic model may help explain this unusual phenomenon. Wolf, an occasional lucid dreamer himself, points out that a piece of holographic film actually generates two images, a virtual image that appears to be in the space behind the film, and a real image that comes into focus in the space in front of the film. One difference between the two is that the light waves that compose a virtual image seem to be diverging/rom an apparent focus or source. As we have seen, this is an illusion, for the virtual image of a hologram has no more extension in space than does the image in a mirror. But the real image of a hologram is formed by light waves that are coming *to* a focus, and this is not an illusion. The real image does possess extension in space. Unfortunately, little attention is paid to this real image in the usual applications of holography because an image that comes into focus in empty air is invisible and can only be seen when dust particles pass through it, or when someone blows a puff of smoke through it.

Wolf believes that all dreams are internal holograms, and ordinary dreams are less vivid because they are virtual images. However, he thinks the brain also has the ability to generate real images, and that is exactly what it does when we are dreaming lucidly. The unusual vibrancy of the lucid dream is due to the fact that the waves are converging and not diverging. "If there is a 'viewer' where these waves focus, that viewer wil) be bathed in the scene, and the scene coming to a focus will 'contain' him. In this way the dream experience will appear 'lucid,' " observes Wolf.[8]

Like Pribram, Wolf believes our minds create the illusion of reality "out there" through the same kind of processes studied by Bekesy. He believes these processes are also what allows the lucid dreamer to create subjective realities in which things like marble floors and flowers are as tangible and real as their so-called objective counterparts. In fact, he thinks our ability to be lucid in our dreams suggests that there may not be much difference between the world at large and the world inside our heads. "When the observer and the observed can separate and say this is the observed and this is the observer, which is an effect one seems to be having when lucid, then I think it's questionable whether [lucid dreams] should be considered subjective," says Wolf.[10]

Wolf postulates that lucid dreams (and perhaps all dreams) are actually visits to parallel universes. They are just smaller holograms within the larger and more inclusive cosmic hologram. He even suggests that the ability to lucid-dream might better be called parallel universe awareness. "I call it parallel universe awareness because I believe that parallel universes arise as other images in the hologram," Wolf states.[11] This and other similar ideas about the ultimate nature of dreaming will be explored in greater depth later in the book.

Hitching a Ride on the Infinite Subway

The idea that we are able to access images from the collective unconscious, or even visit parallel dream universes, pales beside the conclusions of another prominent researcher who has been influenced by the holographic model. He is Stanislav Grof, chief of psychiatric research at the Maryland Psychiatric Research Center and an assistant professor of psychiatry at the Johns Hopkins University School of Medicine.

After more than thirty years of studying nonordinary states of consciousness, Grof has concluded that the avenues of exploration available to our psyches via holographic interconnectedness are more than vast. They are virtually endless.

Grof first became interested in nonordinary states of consciousness in the 1950s while investigating the clinicai uses of the hallucinogen LSD at the Psychiatric Research Institute in his native Prague, Czechoslovakia. The purpose of his research was to determine whether LSD had any therapeutic applications. When Grof began his research, most scientists viewed the LSD experience as little more than a stress reaction, the brain's way of responding to a noxious chemical. But when Grof studied the records of his patient's experiences he did not find evidence of any recurring stress reaction. Instead, there was a definite continuity running through each of the patient's sessions. "Rather than being unrelated and random, the experiential content seemed to represent a successive unfolding of deeper and deeper levels of the unconscious," says Grof.[12] This suggested that repeated LSD sessions had important ramifications for the practice and theory of psychotherapy, and provided Grof and his colleagues with the impetus they needed to continue the research. The results were striking. It quickly became clear that serial LSD sessions were able to expedite the psychotherapeutic process and shorten the time necessary for the treatment of many disorders. Traumatic memories that had haunted individuals for years were unearthed and dealt with, and sometimes even serious conditions, such as schizophrenia, were cured.[IS] But what was even more startling was that many of the patients rapidly moved beyond issues involving their illnesses and into areas that were uncharted by Western psychology.

One common experience was the reliving of what it was like to be in the womb. At first Grof thought these were just imagined experiences, but as the evidence continued to amass he realized that the knowledge of embryology inherent in the descriptions was often far superior to the patients' previous education in the area. Patients accurately described certain characteristics of the heart sounds of their mother, the nature of acoustic phenomena in the peritoneal cavity, specific details concerning blood circulation in the placenta, and even details about the various cellular and biochemical processes taking place. They also described important thoughts and feelings their mother had had during pregnancy and events such as physical traumas she had experienced.

Whenever possible Grof investigated these assertions, and on several occasions was able to verify them by questioning the mother and other individuals involved. Psychiatrists, psychologists, and biologists who experienced prebirth memories during their training for the program (all the therapists who participated in the study also had to undergo several sessions of LSD psychotherapy) expressed similar astonishment at the apparent authenticity of the experiences."

Most disconcerting of all were those experiences in which the patient's consciousness appeared to expand beyond the usual boundaries of the ego and explore what it was like to be other living things and even other objects. For example, Grof had one female patient who suddenly became convinced she had assumed the identity of a female prehistoric reptile. She not only gave a richly detailed description of what it felt like to be encapsuled in such a form, but noted that the portion of the male of the species' anatomy she found most sexually arousing was a patch of colored scales on the side of its head. Although the woman had no prior knowledge of such things, a conversation Grof had with a zoologist later confirmed that in certain species of reptiles, colored areas on the head do indeed play an important role as triggers of sexual arousal.

Patients were also able to tap into the consciousness of their relatives and ancestors. One woman experienced what it was like to be her mother at the age of three and accurately described a frightening event that had befallen her mother at the time. The woman also gave a precise description of the house her mother had lived in as well as the white pinafore she had been wearing—all details her mother later confirmed and admitted she had never talked about before. Other patients gave equally accurate descriptions of events that had befallen ancestors who had lived decades and even centuries before.

Other experiences included the accessing of racial and collective memories. Individuals of Slavic origin experienced what it was like to participate in the conquests of Genghis Khan's Mongolian hordes, to dance in trance with the Kalahari bushmen, to undergo the initiation rites of the Australian aborigines, and to die as sacrificial victims of the Aztecs. And again the descriptions frequently contained obscure historical facts and a degree of knowledge that was often completely at odds with the patient's education, race, and previous exposure to the subject. For instance, one uneducated patient gave a richly detailed account of the techniques involved in the Egyptian practice of embalming and mummification, including the form and meaning of various

amulets and sepulchral boxes, a list of the materials used in the fixing of the mummy cloth, the size and shape of the mummy bandages, and other esoteric facets of Egyptian funeral services. Other individuals tuned into the cultures of the Far East and not only gave impressive descriptions of what it was like to have a Japanese, Chinese, or Tibetan psyche, but also related various Taoist or Buddhist teachings.

In fact, there did not seem to be any limit to what Grof s LSD subjects could tap into. They seemed capable of knowing what it was like to be every animal, and even plant, on the tree of evolution. They could experience what it was like to be a blood cell, an atom, a thermonuclear process inside the sun, the consciousness of the entire planet, and even the consciousness of the entire cosmos. More than that, they displayed the ability to transcend space and time, and occasionally they related uncannily accurate precognitive information. In an even stranger vein they sometimes encountered nonhuman intelligences during their cerebral travels, discarnate beings, spirit guides from "higher planes of consciousness," and other suprahuman entities.

On occasion subjects also traveled to what appeared to be other universes and other levels of reality. In one particularly unnerving session a young man suffering from depression found himself in what seemed to be another dimension. It had an eerie luminescence, and although he could not see anyone he sensed that it was crowded with discarnate beings. Suddenly he sensed a presence very close to him, and to his surprise it began to communicate with him telepathically. It asked him to please contact a couple who lived in the Moravian city of Kromeriz and let them know that their son Ladislav was well taken care of and doing all right. It then gave him the couple's name, street address, and telephone number.

The information meant nothing to either Grof or the young man and seemed totally unrelated to the young man's problems and treatment. Still, Grof could not put it out of his mind. "After some hesitation and with mixed feelings, I finally decided to do what certainly would have made me the target of my colleagues' jokes, had they found out," says Grof. "I went to the telephone, dialed the number in Kromeriz, and asked if I could speak with Ladislav, To my astonishment, the woman on the other side of the line started to cry. When she calmed down, she told me with a broken voice: 'Our son is not with us any more; he passed away, we lost him three weeks ago.' "[IIV]

In the 1960s Grof was offered a position at the Maryland Psychiatric

Research Center and moved to the United States. The center was also doing controlled studies of the psychotherapeutic applications of LSD, and this allowed Grof to continue his research. In addition to examining the effects of repeated LSD sessions on individuals with various mental disorders, the center also studied its effects on "normal" volunteers—doctors, nurses, painters, musicians, philosophers, scientists, priests, and theologians. Again Grof found the same kind of phenomena occurring again and again. It was almost as if LSD provided the human consciousness with access to a kind of infinite subway system, a labyrinth of tunnels and byways that existed in the subterranean reaches of the unconscious, and one that literally connected everything in the universe with everything else.

After personally guiding over three thousand LSD sessions (each lasting at least five hours) and studying the records of more than two thousand sessions conducted by colleagues, Grof became unalterably convinced that something extraordinary was going on. "After years of conceptual struggle and confusion, I have concluded that the data from LSD research indicate an urgent need for a drastic revision of the existing paradigms for psychology, psychiatry, medicine, and possibly science in general," he states. "There is at present little doubt in my mind that our current understanding of the universe, of the nature of reality, and particularly of human beings, is superficial, incorrect, and incomplete."[16]

Grof coined the term *transpersonal* to describe such phenomena, experiences in which the consciousness transcends the customary boundaries of the personality, and in the late 1960s he joined with several other like-minded professionals, including the psychologist and educator Abraham Maslow, to found a new branch of psychology called *transpersonal psychology.*

If our current way of looking at reality cannot account for transpersonal events, what new understanding might take its place? Grof believes it is the holographic model. As he points out, the essential characteristics of transpersonal experiences—the feeling that ail boundaries are illusory, the lack of distinction between part and whole, and the interconnectedness of all things—are all qualities one would expect to find in a holographic universe. In addition, he feels the enfolded nature of space and time in the holographic domain explains why transpersonal experiences are not bound by the usual spatial or temporal limitations.

Grof thinks that the almost endless capacity holograms have for

information storage and retrieval also accounts for the fact that visions, fantasies, and other "psychological gestalts," all contain an enormous amount of information about an individual's personality. A single image experienced during an LSD session might contain information about a person's attitude toward life in general, a trauma he experienced during childhood, how much self-esteem he has, how he feels about his parents, and how he feels about his marriage—all embodied in the overall metaphor of the scene. Such experiences are holographic in another way, in that each small part of the scene can also contain an entire constellation of information. Thus, free association and other analytical techniques performed on the scene's mjnis-cule details can call forth an additional flood of data about the individual involved.

The composite nature of archetypal images can be modeled by the holographic idea. As Grof observes, holography makes it possible to build up a sequence of exposures, such as pictures of every member of a large family, on the same piece of film. When this is done the developed piece of film will contain the image of an individual that represents not one member of the family, but all of them at the same time. "These genuinely composite images represent an exquisite model of a certain type of transpersonal experience, such as the archetypal images of the Cosmic Man, Woman, Mother, Father, Lover, Trickster, Fool, or Martyr," says Grof.[1T]

If each exposure is taken at a slightly different angle, instead of resulting in a composite picture, the piece of film can be used to create a series of holographic images that appear to flow into one another. Grof believes this illustrates another aspect of the visionary experience, namely, the tendency of countless images to unfold in rapid sequence, each *one* appearing and then dissolving into the *next* as if by magic. He thinks holography's success at modeling so many different aspects of the archetypal experience suggests that there is a deep link between holographic processes and the way archetypes are produced.

Indeed, Grof feels that evidence of a hidden, holographic order surfaces virtually every time one experiences a nonordinary state of consciousness:

> Bohm's concept of the unfolded and enfolded orders and the idea that certain important aspects of reality are not accessible to experience and study under ordinary circumstances are of direct relevance for the un-

derstanding of unusual states of consciousness. Individuals who have experienced various conordinary states of consciousness, including we)i-educated and sophisticated scientists from various disciplines, frequently report that they entered hidden domains of reality that seemed to be authentic and in some sense implicit in, and supraordinated to, everyday reality.[18]

Holotropic Therapy

Perhaps Grofs most remarkable discovery is that the same phenomena reported by individuals who have taken LSD can also be experienced without resorting to drugs of any kind. To this end, Grof and his wife, Christina, have developed a simple, nondrug technique for inducing these *kolotropic,* or nonordinary, states of consciousness. They define a holotropic state of consciousness as one in which it is possible to access the holographic labyrinth that connects all aspects of existence. These include one's biological, psychological, racial, and spiritual history, the past, present, and future of the world, other levels of reality, and all the other experiences already discussed in the context of the LSD experience.

The Grofs call their technique *holotropic therapy* and use only rapid and controlled breathing, evocative music, and massage and body work, to induce altered states of consciousness. To date, thousands of individuals have attended their workshops and report experiences that are every bit as spectacular and emotionally profound as those described by subjects of Grofs previous work on LSD. Grof describes his current work and gives a detailed account of his methods in his book *The Adventure of Self-Discovery.*

Vortices of Thought and Multiple Personalities

A number of researchers have used the holographic model to explain various aspects of the thinking process itself. For example, New York psychiatrist Edgar A. Levenson believes the hologram provides a valuable model for understanding the sudden and transformative changes individuals often experience during psychotherapy. He bases his conelusion on the fact that such changes take place no matter what technique or psychoanalytic approach the therapist uses. Hence, he feels all psychoanalytic approaches are purely ceremonial, and change is due to something else entirely.

Levenson believes that something is resonance. A therapist always knows when therapy is going well, he observes. There is a strong feeling that the pieces of an elusive pattern are all about to come together. The therapist is not saying anything new to the patient, but instead seems to be resonating with something the patient already unconsciously knows: "It is as though a huge, three-dimensional, spatially coded representation of the patient's experience develops in the therapy, running through every aspect of his life, his history and his participation with the therapist. At some point there is a kind of 'overload' and everything falls into place."[19]

Levenson believes these three-dimensional representations of experience are holograms buried deep in the patient's psyche, and a resonance of feeling between the therapist and patient causes them to emerge in a process similar to the way a laser of a certain frequency causes an image made with a laser of the same frequency to emerge from a multiple image hologram. "The holographic model suggests a radically new paradigm which might give us a fresh way of perceiving and connecting clinical phenomena which have always been known to be important, but were relegated to the 'art' of psychotherapy," says Levenson. "It offers a possible theoretical template for change and a practical hope of clarifying psychotherapeutic technique."[20]

Psychiatrist David Shainberg, associate dean of the Postgraduate Psychoanalytic Program at the William Alanson White Institute of Psychiatry in New York, feels Bohm's assertion that thoughts are like vortices in a river should be taken literally and explains why our attitudes and beliefs sometimes become fixed and resistant to change. Studies have shown that vortices are often remarkably stable. The Great Red Spot of Jupiter, a giant vortex of gas over 25,000 miles wide, has remained intact since it was first discovered 300 years ago. Shainberg believes this same tendency toward stability is what causes certain vortices of thought (our ideas and opinions) to become occasionally cemented in our consciousness.

He feeis the virtual permanence of some vortices is often detrimental to our growth as human beings. A particularly powerful vortex can dominate our behavior and inhibit our ability to assimilate new ideas and information. It can cause us to become repetitious, create block-

ages in the creative flow of our consciousness, keep us from seeing the wholeness of ourselves, and make us feel disconnected from our species. Shainberg believes that vortices may even explain things like the nuclear arms race: "Look at the nuclear arms race as a vortex arising out of the greed of human beings who are isolated in their separate selves and do not feel the connection to other human beings. They are also feeling a peculiar emptiness and become greedy for everything they ean get to fill themselves. Hence nuclear industries proliferate because they provide large amounts of money and the greed is so extensive that such people do not care what might happen from their actions."[81]

Like Bohm, Shainberg believes our consciousness is constantly unfolding out of the implicate order, and when we allow the same vortices to take form repeatedly he feels we are erecting a barrier between ourselves and the endless positive and novel interactions we could be having with this infinite source of all being. To catch a glimmer of what we are missing, he suggests we look at a child. Children have not yet had the time to form vortices, and this is reflected in the open and flexible way they interact with the world. According to Shainberg the sparkling aliveness of a child expresses the very essence of the unfold-ing-enfolding nature of consciousness when it is unimpeded.

If you want to become aware of your own frozen vortices of thought, Shainberg recommends you pay close attention to the way you behave in conversation. When people with set beliefs converse with others, they try to justify their identities by espousing and defending their opinions. Their judgments seldom change as a result of any new information they encounter, and they show little interest in allowing any real conversational interaction to take place. A person who is open to the flowing nature of consciousness is more willing to see the frozen condition of the relationships imposed by such vortices of thought. They are committed to exploring conversational interactions, rather than endlessly repeating a static litany of opinions. "Human response and articulation of that response, feedback of reactions to that response and the clarifying of the relationships between different responses, are the way human beings participate in the flow of the implicate order," says Shainberg.[25]

Another psychological phenomena that bears several earmarks of the implicate is multiple personality disorder, or MPD. MPD is a bizarre syndrome in which two or more distinct personalities inhabit a

single body. Victims of the disorder, or "multiples," often have no awareness of their condition. They do not realize that control of their body is being passed back and forth between different personalities and instead feel they are suffering from some kind of amnesia, confusion, or black-out spells. Most multiples average between eight to thirteen personalities, although so-called super-multiples may have more than a hundred subpersonalities.

One of the most telling statistics regarding multiples is that 97 percent of them have had a history of severe childhood trauma, often in the form of monstrous psychological, physical, and sexual abuse. This has led many researchers to conclude that becoming a multiple is the psyche's way of coping with extraordinary and soul-crushing pain. By dividing up into one or more personalities the psyche is able to parcel out the pain, in a way, and have several personalities bear what would be too much for just one personality to withstand.

In this sense becoming a multiple may be the ultimate example of what Bohm means by fragmentation. It is interesting to note that when the psyche fragments itself, it does not become a collection of broken and jagged-edged shards, but a collection of smaller wholes, complete and self-sustaining with their own traits, motives, and desires. Although these wholes are not identical copies of the original personality, they are related to the dynamics of the original personality, and this in itself suggests that some kind of holographic process is involved.

Bohm's assertion that fragmentation always eventually proves destructive is also apparent in the syndrome. Although becoming a multiple allows a person to survive an otherwise unendurable childhood, it brings with it a host of unpleasant side effects. These may include depression, anxiety and panic attacks, phobias, heart and respiratory problems, unexplained nausea, migrainelike headaches, tendencies toward self-mutilation, and many other mental and physical disorders. Startlingly, but regular as clockwork, most multiples are diagnosed when they are between the ages of twenty-eight and thirty-five, a "coincidence" that suggests that some inner alarm system may be going off at that age, warning them that it is imperative they are diagnosed and thus obtain the help they need. This idea seems borne out by the fact that multiples who reach their forties before they are diagnosed frequently report having the sense that if they did not seek help soon, any chance of recovery would be lost.[13] Despite the tempo-

rary advantages the tortured psyche gains by fragmenting itself, it is clear that mental and physical well-being, and perhaps even survival, still depend on wholeness.

Another unusual feature of MPD is that each of a multiple's personalities possesses a different brain-wave pattern. This is surprising, for as Frank Putnam, a National Institutes of Health psychiatrist who has studied this phenomenon, points out, normally a person's brain-wave pattern does not change even in states of extreme emotion. Brainwave patterns are not the only thing that varies from personality to personality. Blood flow patterns, muscle tone, heart rate, posture, and even allergies can ail change as a multiple shifts from one self to the next.

Since brain-wave patterns are not confined to any single neuron or group of neurons, but are a global property of the brain, this too suggests that *some* kind of holographic process may be at work. Just as a multiple-image hologram can store and project dozens of whole scenes, perhaps the brain hologram can store and call forth a similar multitude of whole personalities. In other words, perhaps what we call "self" is also a hologram, and when the brain of a multiple clicks from one holographic self to the next, these slide-projectorlike shuttlings are reflected in the global changes that take place in brain-wave activity as well as in the body in general (see fig. 10). The physiological changes that occur as a multiple shifts from one personality to the next also have profound implications for the relationship between mind and health, and will be discussed at greater length in the next chapter.

A Flaw in the Fabric of Reality

Another of Jung's great contributions was defining the concept of synehronicity. As mentioned in the introduction, synchronicities are coincidences that are so unusual and so meaningful they could hardly be attributed to chance alone. Each of us has experienced a synchronicity at some point in our lives, such as when we learn a strange new word and then hear it used in a news broadcast a few hours later, or when we think about an obscure subject and then notice other people talking about it. A few years back I experienced a series of synchronicities involving

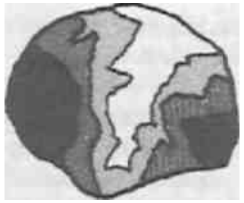


FIGURE 10. The brain-wave patterns of four subpersonalities in an individual suffering from multiple personality disorder. Is it possible that the brain uses holographic principles to store the vast amount of information necessary to house dozens and even hundreds of personalities in a single body? {Redrawn by the author from original art in an article by Bennett G. Braun in the *American Journal of Clinical Hypnosis)*

the rodeo showman Buffalo Bill. Occasionally, while doing a modest workout in the morning before I start writing, I turn on the television. One morning in January 1983, I was doing push-ups while a game show was on, and I suddenly found myself shouting out the name "Buffalo Bill!" At first I was puzzled by my outburst, but then I realized the game-show host had asked the question "What other name was William Frederick Cody known by?" Although I had not been paying conscious attention to the show, for some reason my unconscious mind had zeroed in on this question and had answered it. At the time 1 did not think much of the occurrence and went about my day. A few hours later a friend telephoned and asked me if I could settle a friendly argument he was having concerning a piece of theater trivia. I offered to try, whereupon my friend asked, "Is it true that John Barrymore's dying words were, 'Aren't you the illegitimate son of Buffalo Bill?' " I thought this second encounter with Buffalo Bill was odd but still chalked it up to coincidence until later that day when a *Smithsonian* magazine arrived in the mail, and I opened it. One of the lead articles was titled "The Last of the Great Scouts Is Back Again." It was about... you guessed it: Buffalo Bill. (Incidentally, I

was unable to answer my friend's trivia question and still have no idea whether they were Barrymore's dying words or not)

As incredible as this experience was, the only thing that seemed meaningful about it was its improbable nature. There is, however, another kind of synchronicity that is noteworthy not only because of its improbability, but because of its apparent relationship to events taking place deep in the human psyche. The classic example of this is Jung's scarab story. Jung was treating a woman whose staunchly rational approach to life made it difficult for her to benefit from therapy. After a number of frustrating sessions the woman told Jung about a dream involving a scarab beetle. Jung knew that in Egyptian mythology the scarab represented rebirth and wondered if the woman's unconscious mind was symbolically announcing that she was about to undergo some kind of psychological rebirth. He was just about to tell her this when something tapped on the window, and he looked up to see a gold-green scarab on the other side of the glass (it was the only time a scarab beetle had ever appeared at Jung's window). He opened the window and allowed the scarab to fly into the room as he presented his interpretation of the dream. The woman was so stunned that she tempered her excessive rationality, and from that point on her response to therapy improved.

Jung encountered many such meaningful coincidences during his psychotherapeutic work and noticed that they almost always accompanied periods of emotional intensity and transformation: fundamental changes in belief, sudden and new insights, deaths, births, even changes in profession. He also noticed that they tended to peak when the new realization or insight was just about to surface in a patient's consciousness. As his ideas became more widely known, other therapists began reporting their own experiences with synchronicity.

For example, Zurich-based psychiatrist Carl Alfred Meier, a longtime associate of Jung's, tells of a synchronicity that spanned many years. An American woman suffering from serious depression traveled all the way from Wuchang, China, to be treated by Meier. She was a surgeon and had headed a mission hospital in Wuchang for twenty years. She had also become involved in the culture and was an expert in Chinese philosophy. During the course of her therapy she told Meier of a dream in which she had seen the hospital with one of its wings destroyed. Because her identity was so intertwined with the hospital, Meier felt her dream was telling her she was losing her sense of self, her American identity, and that was the cause of her depression. He

advised her to return to the States, and when she did her depression quickly vanished, just as he had predicted. Before she departed he also had her do a detailed sketch of the crumbling hospital.

Years later the Japanese attacked China and bombed Wuchang Hospital. The woman sent Meier a copy of *Life* magazine containing a double-page photograph of the partially destroyed hospital, and it was identical to the drawing she had produced nine years earlier. The symbolic and highly personal message of her dream had somehow spilled beyond the boundaries of her psyche and into physical reality,[24]

Because of their striking nature, Jung became convinced that such synchronicities were not chance occurrences, but were in fact related to the psychological processes of the individuals who experienced them. Since he could not conceive how an occurrence deep in the psyehe could *cause* an event or series of events in the physical world, at least in the classical sense, he proposed that some new principle must be involved, an *acausal* connecting principle hitherto unknown to science.

When Jung first advanced this idea, most physicists did not take it seriously {although one eminent physicist of the time, Wolfgang Pauli, felt it was important enough to coauthor a book with Jung on the subject entitled *The Interpretation and Nature of the Psyche).* But now that the existence of nonlocal connections has been established, some physicists are giving Jung's idea another look." Physicist Paul Davies states, "These *non-local* quantum effects are indeed a form of synchronicity in the sense that they establish a connection—more precisely a correlation—between events for which any form of causal linkage is forbidden."[25]

Another physicist who takes synchronicity seriously is F. David Peat. Peat believes that Jungian-type synchronicities are not only real, but offer further evidence of the implicate order. As we have seen, according to Bohm the apparent separateness of consciousness and matter is an illusion, an artifact that occurs only after both have unfolded into the explicate world of objects and sequential time. If there is no division between mind and matter in the implicate, the ground from which all things spring, then it is not unusual to expect that reality might still be shot through with traces of this deep connectivity. Peat believes that synchronicities are therefore "flaws" in the

As has been mentioned, nonlocal effects are not due to a cause-and-effect relationship and ate therefore acausal.

fabric of reality, momentary fissures that allow us a brief glimpse of the immense and unitary order underlying all of nature.

Put another way, Peat thinks that synchronicities reveal the absence of division between the physical world and our inner psychological reality. Thus the relative scarcity of synchronous experiences in our lives shows not only the extent to which we have fragmented ourselves from the general field of consciousness, but also the degree to which we have sealed ourselves off from the infinite and dazzling potential of the deeper orders of mind and reality. According to Peat, when we experience a synchrony city, what we are really experiencing "is the human mind operating, for a moment, in its true order and extending throughout society and nature, moving through orders of increasing subtlety, reaching past the source of mind and matter into creativity itself."[26]

This is an astounding notion. Virtually all of our commonsense prejudices about the world are based on the premise that subjective and objective reality are very much separate. That is why synchronicities seem so baffling and inexplicable to us. But if there is ultimately no division between the physical world and our inner psychological processes, then we must be prepared to change more than just our commonsense understanding of the universe, for the implications are staggering.

One implication is that objective reality is more like a dream than we have previously suspected. For example, imagine dreaming that you are sitting at a table and having an evening meal with your boss and his wife. As you know from experience, all the various props in the dream—the table, the chairs, the plates, and salt and pepper shakers—appear to be separate objects. Imagine also that you experience a synchronicity in the dream; perhaps you are served a particularly unpleasant dish, and when you ask the waiter what it is, he tells you that the name of the dish is Your Boss. Realizing that the unpleasant^ ness of the dish betrays your true feelings about your boss, you become embarrassed and wonder how an aspect of your "inner" self has managed to spill over into the "outer" reality of the scene you are dreaming. Of course, as soon as you wake up you realize the synchronicity was not so strange at all, for there was really no division between your "inner" self and the "outer" reality of the dream. Similarly, you realize that the apparent separateness of the various objects in the dream was also an illusion, for everything was produced by a

deeper and more fundamental order—the unbroken wholeness of your own unconscious mind.

If there is no division between the mental and physical worlds, these same qualities are also true of objective reality. According to Peat, this does not mean the material universe is an illusion, because both the implicate and the explicate play a role in creating reality. Nor does it mean that individuality is iost, any more than the image of a rose is lost once it is recorded in a piece of holographic film. It simply means that we are again like vortices in a river, unique but inseparable from the flow of nature. Or as Peat puts it, "the self lives on but as one aspect of the more subtle movement that involves the order of the whole of consciousness."[27]

And so we have come full circle, from the discovery that consciousness contains the whole of objective reality—the entire history of biological life on the planet, the world's religions and mythologies, and the dynamics of both blood cells and stars—to the discovery that the material universe can also contain within its warp and weft the innermost processes of consciousness. Such is the nature of the deep connectivity that exists between all things in a holographic universe. In the next chapter we will explore how this connectivity, as well as other aspects of the holographic idea, affect our current understanding of health.

4

I Sing the Body Holographic

You will hardly know who 1 am or what I mean. But
I shall be good health to you nevertheless. . . .

—Walt Whitman, "Song of Myself*

A sixty-one-year-old man we'll call Frank was diagnosed as having an almost always fatal form of throat cancer and told he had less than a 5 percent chance of surviving. His weight had dropped from 130 to 98 pounds. He was extremely weak, could barely swallow his own saliva, and was having trouble breathing. Indeed, his doctors had debated whether to give him radiation therapy at all, because there was a distinct possibility the treatment would only add to his discomfort without significantly increasing his chances for survival. They decided to proceed anyway.

Then, to Frank's great good fortune, Dr. 0. Carl Simonton, a radiation oncologist and medical director of the Cancer Counseling and Research Center in Dallas, Texas, was asked to participate in his treatment Simonton suggested that Frank himself could influence the course of his own disease. Simonton then taught Frank a number of relaxation and mental-imagery techniques he and his colleagues had developed. From that point on, three times a day, Frank pictured the radiation he received as consisting of millions of tiny bullets of energy bombarding his cells. He also visualized his cancer cells as weaker and

more confused than his norma) cells, and thus unable to repair the damage they suffered. Then he visualized his body's white blood cells, the soldiers of the immune system, coming in, swarming over the dead and dying cancer cells, and carrying them to his liver and kidneys to be flushed out of his body.

The results were dramatic and far exceeded what usually happened in such cases when patients were treated solely with radiation. The radiation treatments worked like magic. Frank experienced almost none of the negative side effects—damage to skin and mucous membranes—that normally accompanied such therapy. He regained his lost weight and his strength, and in a mere two months all signs of his cancer had vanished. Simonton believes Frank's remarkable recovery was due in large part to his daily regimen of visualization exercises.

In a follow-up study, Simonton and his colleagues taught their mental-imagery techniques to 159 patients with cancers considered medically incurable. The expected survival time for such a patient is twelve months. Four years later 63 of the patients were still alive. Of those, 14 showed no evidence of disease, the cancers were regressing in 12, and in 17 the disease was stable. The average survival time of the group as a whole was 24.4 months, over twice as long as the national norm.[1]

Simonton has since conducted a number of similar studies, all with positive results. Despite such promising findings, his work is still considered controversial. For instance, critics argue that the individuals who participate in Simonton's studies are not "average" patients. Many of them have sought Simonton out for the express purpose of learning his techniques, and this shows that they already have an extraordinary fighting spirit. Nonetheless, many researchers find Simonton's results compelling enough to support his work, and Simonton himself has set up the Simonton Cancer Center, a successful research and treatment facility in Pacific Palisades, California, devoted to teaching imagery techniques to patients who are fighting various illnesses. The therapeutic use of imagery has also captured the imagination of the public, and a recent survey revealed that it was the fourth most frequently used alternative treatment for cancer.[2]

How is it that an image formed in the mind can have an effect on something as formidable as an incurable cancer? Not surprisingly the holographic theory of the brain can be used to explain this phenomenon as well. Psychologist Jeanne Achterberg, director of research and rehabilitation science at the University of Texas Health Science Center

in Dallas, Texas, and one of the scientists who helped develop the imagery techniques Simonton uses, believes it is the holographic imaging capabilities of the brain that provide the key.

As has been noted, all experiences are ultimately just neurophysio-logical processes taking place in the brain. According to the holographic model the reason we experience some things, such as emotions, as internal realities and others, such as the songs of birds and the barking of dogs, as external realities is because that is where the brain localizes them when it creates the internal hologram that we experience as reality. However, as we have also seen, the brain cannot always distinguish between what is "out there" and what it believes to be "out there," and that is why amputees sometimes have phantom limb sensations. Put another way, in a brain that operates holograph-ically, the remembered image of a thing can have as much impact on the senses as the thing itself.

It can also have an equally powerful effect on the body's physiology, a state of affairs that has been experienced firsthand by anyone who has ever felt their heart race after imagining hugging a loved one. Or anyone who has ever felt their paims grow sweaty after conjuring up the memory of some unusually frightening experience. At first glance the fact that the body cannot always distinguish between an imagined event and a real one may seem strange, but when one takes the holographic model into account—a model that asserts that *all* experiences, whether real or imagined, are reduced to the same common language of holographically organized wave forms—the situation becomes much less puzzling. Or as Achterberg puts it, "When images are regarded in the holographic manner, their omnipotent influence on physical function logically follows. The image, the behavior, and the physiological concomitants are a unified aspect of the same phenomenon."[8]

Bohm uses his idea of the implicate order, the deeper and nonlocal level of existence from which our entire universe springs, to echo the sentiment "Every action starts from an intention in the implicate order. The imagination is already the creation of the form; it already has the intention and the germs of all the movements needed to carry it out And it affects the body and so on, so that as creation takes place in that way from the subtler levels of the implicate order, it goes through them until it manifests in the explicate."[4] In other words, in the implicate order, as in the brain itself, imagination and reality are ultimately indistinguishable, and it should therefore come as no surprise to us that images in the mind can ultimately manifest as realities in the physical body.

Achterberg found that the physiological effects produced through the use of imagery are not only powerful, but can also be extremely specific. For example, the term *white blood cell* actually refers to a number of different kinds of cell. In one study, Achterberg decided to see if she could train individuals to increase the number of only one particular type of white blood cell in their body. To do this she taught one group of college students how to image a cell known as a neutrophil, the major constituent of the white blood cell population. She trained a second group to image T-cells, a more specialized kind of white blood cell. At the end of the study the group that learned the neutrophil imagery had a significant increase in the number of neutrophils in their body, but no change in *the* number of T-cells. The group that learned to image T-cells had a significant increase in the number of that kind of cell, but the number of neutrophils in their body remained the same.[3]

Achterberg says that belief is also critical to a person's health. As she points out, virtually everyone who has had contact with the medical world knows at least one story of a patient who was sent home to die, but because they "believed" otherwise, they astounded their doctors by completely recovering. In her fascinating book *Imagery in Healing* she describes several of her own encounters with such cases. In one, a woman was comatose on admission, paralyzed, and diagnosed with a massive brain tumor. She underwent surgery to "debulk" her tumor (remove as much as is safely possible), but because she was considered close to death, she was sent home without receiving either radiation or chemotherapy.

Instead of promptly dying, the woman became stronger by the day. As her biofeedback therapist, Achterberg was able to monitor the woman's progress, and by the end of sixteen months the woman showed no evidence of cancer. Why? Although the woman was intelligent in a worldly sense, she was only moderately educated and did not really know the meaning of the word *tumor*—or the death sentence it imparted. Hence, she did not believe she was going to die and overcame her cancer with the same confidence and determination she'd used to overcome every other illness in her life, says Achterberg. When Achterberg saw her last, the woman no longer had any traces of paralysis, had thrown away her leg braces and her cane, and had even been out dancing a couple of times.[6]

Breznitz found that the stress hormone levels in the soldiers' blood always reflected their estimates and not the actual distance they had marched.[10] In other words, *their bodies responded not to reality, but to what they were imaging as reality.*

According to Dr. Charles A. Garfield, a former National Aeronautics and Space Administration (NASA) researcher and current president of the Performance Sciences Institute in Berkeley, California, the Soviets have extensively researched the relationship between imagery and physical performance. In one study a phalanx of world-class Soviet athietes was divided into four groups. The first group spent 100 percent of their training time in training. The second spent 75 percent of their time training and 25 percent of their time visualizing the exact movements and accomplishments they wanted to achieve in their sport. The third spent 50 percent of their time training and 50 percent visualizing, and the fourth spent 25 percent training and 75 percent visualizing. Unbelievably, at the 1980 Winter Games in Lake Placid, New York, the fourth group showed the greatest improvement in performance, followed by groups three, two, and one, in that order.[11]

Garfield, who has spent hundreds of hours interviewing athletes and sports researchers around the world, says that the Soviets have incorporated sophisticated imagery techniques into many of their athletic programs and that they believe mental images act as precursors in the process of generating neuromuscular impulses. Garfield believes imagery works because movement is recorded holographically in the brain. In his book *Peak Performance: Mental Training Techniques of the World's Greatest Athletes,* he states, "These images are holographic and function primarily at the subliminal level. The holographic imaging mechanism enables you to quickly solve spatial problems such as assembling a complex machine, choreographing a dance routine, or running visual images of plays through your mind."[12]

Australian psychologist Alan Richardson has obtained similar results with basketball players. He took three groups of basketball players and tested their ability to make free throws. Then he instructed the first group to spend twenty minutes a day practicing free throws. He told the second group not to practice, and had the third group spend twenty minutes a day visualizing that they were shooting perfect baskets. As might be expected, the group that did nothing showed no improvement The first group improved 24 percent, but through the power of imagery alone, the third group improved an astonishing 23 percent, almost as much as the group that practiced.[13]

The Lack of Division Between Health and Illness

Physician Larry Dossey believes that imagery is not the only tool the holographic mind can use to effect changes in the body. Another is simply the recognition of the unbroken wholeness of all things. As Dossey observes, we have a tendency to view illness as external to us. Disease comes from without and besieges us, upsetting our well-being. But if space and time, and all other things in the universe, are truly inseparable, then we cannot make a distinction between health and disease.

How can we put this knowledge to practical use in our lives? When we stop seeing illness as something separate and instead view it as part of a larger whole, as a milieu of behavior, diet, sleep, exercise patterns, and various other relationships with the world at large, we often get better, says Dossey. As evidence he calls attention to a study in which chronic headache sufferers were asked to keep a diary of the frequency and severity of their headaches. Although the record was intended to be a first step in preparing the headache sufferers for further treatment, most of the subjects found that when they began to keep a diary, their headaches disappeared![M]

In another experiment cited by Dossey, a group of epileptic children and their families were videotaped as they interacted with *one* an other. Occasionally, there were emotional outbursts during the ses sions, which were often followed by actual seizures. When the children were shown the tapes and saw the relationship between these emo tional events and their seizures, they became almost seizure-free.[15] Why'.' By keeping a diary or watching a videotape, the subjects were able to see their condition in relationship to the larger pattern of their lives. When this happens, illness can no longer be viewed "as an" .' intruding disease originating elsewhere, but as part of a process of living which can accurately be described as an unbroken whole," says Dossey. "When our focus is toward a principle of relatedness and oneness, and away from fragmentation and isolation, health en sues."[16] *—J*

Dossey feels the word *patient* is as misleading as the word *particle.* Instead of being separate and fundamentally isolated biological units, we are essentially dynamic processes and patterns that are no more analyzable into parts than are electrons. More than this, we are connected, connected to the forces that create both sickness and health,

to the beliefs of our society, to the attitudes of our friends, our family, and our doctors, and to the images, beliefs, and even the *very* words we use to apprehend the universe.

In a holographic universe we are also connected to our bodies, and in the preceding pages we have seen some of the ways these connections manifest themselves. But there are others, perhaps even an infinity of others. As Pribram states, "If indeed every part of our body is a reflection of the whole, then there must be all kinds of mechanisms to control what's going on. Nothing is firm at this point"[17] Given our ignorance in the matter, instead of asking *how* the mind controls the body holographic, perhaps a more important question is, What is the extent of this control? Are there any limitations on it, and if so, what are they? That is the question to which we now turn our attention.

The Healing Power of Nothing at All

Another medical phenomenon that provides us with a tantalizing glimpse of the control the mind has over the body is the placebo effect. A placebo is any medical treatment that has no specific action on the body but is given either to humor a patient, or as a control in a double-blind experiment, that is, a study in which one group of individuals is given a real treatment and another group is given a fake treatment. In such experiments neither the researchers nor the individuals being tested know which group they are in so that the effects of the real treatment can be assessed more accurately. Sugar pills are often used as placebos in drug studies. So is saline solution (distilled water with salt in it), although placebos need not always be drugs. Many believe that any medical benefit derived from crystals, copper bracelets, and other nontraditional remedies is also due to the placebo effect.

Even surgery has been used as a placebo. In the 1950s, angina pectoris, recurrent pain in the chest and left arm due to decreased blood flow to the heart, was commonly treated with surgery. Then some resourceful doctors decided to conduct an experiment Rather than perform the customary surgery, which involved tying off the mammary artery, they cut patients open and then simply sewed them back up again. The patients who received the sham surgery reported just as much relief as the patients who had the full surgery. The full

surgery, as it turned out, was only producing a placebo effect[18] Nonetheless, the success of the sham surgery indicates that somewhere deep in all of us we have the ability to control angina pectoris.

And that is not all. In the last half century the placebo effect has been extensively researched in hundreds of different studies around the world. We now know that on average 35 percent of all people who receive a given placebo will experience a significant effect although this number can vary greatly from situation to situation. In addition to angina pectoris, conditions that have proved responsive to placebo treatment include migraine headaches, allergies, fever, the common cold, acne, asthma, warts, various kinds of pain, nausea and seasickness, peptic ulcers, psychiatric syndromes such as depression and anxiety, rheumatoid and degenerative arthritis, diabetes, radiation sickness, Parkinsonism, multiple sclerosis, and cancer.

Clearly these range from the not so serious to the life threatening, but placebo effects on even the mildest conditions may involve physiological changes that are near miraculous. Take, for example, the lowly wart. Warts are a small tumorous growth on the skin caused by a virus. They are also extremely easy to cure through the use of placebos, as is evidenced by the nearly endless folk rituals—ritual itself being a kind of placebo—that are used by various cultures to get rid of them. Lewis Thomas, president emeritus of Memorial Sloan-Kettering Cancer Center in New York, tells of one physician who regularly rid his patients of warts simply by painting a harmless purple dye on them. Thomas feels that explaining this small miracle by saying it's just the unconscious mind at work doesn't begin to do the placebo effect justice. "If my unconscious can figure out how to manipulate the mechanisms needed for getting around that virus, and for deploying all the various cells in the correct order for tissue rejection, then all I have to say is that my unconscious is a lot further along than I am," he states.[19]

The effectiveness of a placebo in any given circumstance also varies greatly. In nine double-blind studies comparing placebos to aspirin, placebos proved to be 54 percent as effective as the actual analgesic.[20] Prom this one might expect that placebos would be even less effective when compared to a much stronger painkiller such as morphine, but this is not the case. In six double-blind studies placebos were found to be 56 percent as effective as morphine in relieving pain![21]

Why? One factor that can affect the effectiveness of a placebo is the method in which it is given. Injections are generally perceived as more

potent than pills, and hence giving a placebo in an injection can enhance its effectiveness. Similarly, capsules are often seen as more effective than tablets, and even the size, shape, and color of a pill can play a role. In a study designed to determine the suggestive value of a pill's color, researchers found that people tend to view yellow or orange pills as mood manipulators, either stimulants or depressants. Dark red pills are assumed to be sedatives; lavender pills, hallucinogens; and white pills, painkillers.[22]

Another factor is the attitude the doctor conveys when he prescribes the placebo. Dr. David Sobel, a placebo specialist at Kaiser Hospital, California, relates the story of a doctor treating an asthma patient who was having an unusually difficult time keeping his bronchial tubes open. The doctor ordered a sample of a potent new medicine from a pharmaceutical company and gave it to the man. Within minutes the man showed spectacular improvement and breathed more easily. However, the next time he had an attack, the doctor decided to see what would happen if he gave the man a placebo. This time the man complained that there must be something wrong with the prescription because it didn't completely eliminate his breathing difficulty. This convinced the doctor that the sample drug was indeed a potent new asthma medication—until he received a letter from the pharmaceutical company informing him that instead of the new drug, they had accidentally sent him a placebo.' Apparently it was the doctor's unwitting enthusiasm for the first placebo, and not the second, that accounted for the discrepancy.[23]

In terras of the holographic model, the man's remarkable response to the placebo asthma medication can again be explained by the mind/body's ultimate inability to distinguish between an imagined reality and a real one. The man believed he was being given a powerful new asthma drug, and this belief had as dramatic a physiological effect on his lungs as if he had been given a real drug. Achterberg's warning that the neural holograms that impact on our health are varied and multifaceted is also underscored by the fact that even something as subtle as the doctor's slightly different attitude (and perhaps body language) while administering the two placebos was enough to cause one to work and the other to fail. It is clear from this that even information received subliminally can contribute greatly to the beliefs and mental images that impact on our health. One wonders how many drugs have worked (or not worked) because of the attitude the doctor conveyed while administering them.

Tumors That Melt Like Snowballs on a Hot Stove

Understanding the role such factors play in a placebo's effectiveness is important, for it shows how our ability to control the body holographic is molded by our beliefs. Our minds have the power to get rid of warts, to clear our bronchial tubes, and to mimic the painkilling ability of morphine, but because we are unaware that we possess the power, we must be fooled into using it. This might almost be comic if it were not for the tragedies that often result from our ignorance of our own power.

No incident better illustrates this than a now famous case reported by psychologist Bruno Klopfer. Klopfer was treating a man named Wright who had advanced cancer of the lymph nodes. All standard treatments had been exhausted, and Wright appeared to have little time left. His neck, armpits, chest, abdomen, and groin were filled with tumors the size of oranges, and his spleen and liver were so enlarged that two quarts of milky fluid had to be drained out of his chest every day.

But Wright did not want to die. He had heard about an exciting new drug called Krebiozen, and he begged his doctor to let him try it. At first his doctor refused because the drug was only being tried on people with a life expectancy of at least three months. But Wright was so unrelenting in his entreaties, his doctor finally gave in. He gave Wright an injection of Krebiozen on Friday, but in his heart of hearts he did not expect Wright to last the weekend. Then the doctor went home.

To his surprise, on the following Monday he found Wright out of bed and walking around. Klopfer reported that his tumors had "melted like snowballs on a hot stove" and were half their original size. This was a far more rapid decrease in size than even the strongest X-ray treatments could have accomplished. Ten days after Wright's first Krebiozen treatment, he left the hospital and was, as far as his doctors could tell, cancer free. When he had entered the hospital he had needed an oxygen mask to breathe, but when he left he was well enough to fly his own plane at 12,000 feet with no discomfort.

Wright remained well for about two months, but then articles began to appear asserting that Krebiozen actually had no effect on cancer of the lymph nodes. Wright, who was rigidly logical and scientific in his thinking, became very depressed, suffered a relapse, and was readmitted to the hospital. This time his physician decided to try an experi-

ment. He told Wright that Krebiozen was every bit as effective as it had seemed, but that some of the initial supplies of the drug had deteriorated during shipping. He explained, however, that he had a new highly concentrated version of the drug and could treat Wright with this. Of course the physician did not have a new version of the drug and intended to inject Wright with plain water. To create the proper atmosphere he even went through an elaborate procedure before injecting Wright with the placebo.

Again the results were dramatic. Tumor masses meited, chest fluid vanished, and Wright was quickly back on his feet and feeling great. He remained symptom-free for another two months, but then the American Medical Association announced that a nationwide study of Krebiozen had found the drug worthless in the treatment of cancer. This time Wright's faith was completely shattered. His cancer blossomed anew and he died two days later.[34]

Wright's story is tragic, but it contains a powerful message: When we are fortunate enough to bypass our disbelief and tap the healing forces within us, we can cause tumors to melt away overnight

In the case of Krebiozen only one person was involved, but there are similar cases involving many more people. Take a chemotherapeutic agent called cis-platinum. When ess-platinum first became available it, too, was touted as a wonder drug, and 75 percent of the people who received it benefited from the treatment. But after the initial wave of excitement and the use of cis-platinum became more routine, its rate of effectiveness dropped to about 25 to 30 percent. Apparently most of the benefit obtained from cis-platinum was due to the placebo effect.[25]

Do Any Drugs Really Work?

Such incidents raise an important question. If drugs such as Krebiozen and cis-platinum work when we believe in them and stop working when we stop believing in them, what does this imply about the nature of drugs in general? This is a difficult question to answer, but we do have some clues. For instance, physician Herbert Benson of Harvard Medical School points out that the vast majority of treatments prescribed prior to this century, from leeching to consuming lizard's blood, were useless, but because of the placebo effect, they were no doubt helpful at least some of the time.[2e]

Benson, along with Dr. David P. McCallie, Jr., of Harvard's Thorn-dike Laboratory, reviewed studies of various treatments for angina pectoris that have been prescribed over the years and discovered that although remedies have come and gone, the success rates—even for treatments that are now discredited—have always remained high.[27] From these two observations it is evident that the placebo effect has played an important roie in medicine in the past, but does it still play a role today? The answer, it seems, is yes. The federal Office of Technology Assessment estimates that more than 75 percent of all current medical treatments have not been subjected to sufficient scientific scrutiny, a figure that suggests that doctors may still be giving placebos and not know it (Benson, for one, believes that, at the very least, many over-the-counter medications act primarily as placebos).[2"]

Given the evidence we have looked at so far, one might almost wonder if all drugs are placebos. Clearly the answer is no. Many drugs are effective whether we believe in them or not: Vitamin C gets rid of scurvy, and insulin makes diabetics better even when they are skeptical. But still the issue is not quite as clear-cut as it may seem. Consider the following.

In a 1962 experiment Drs. Harriet Linton and Robert Langs told test subjects they were going to participate in a study of the effects of LSD, but then gave them a placebo instead. Nonetheless, half an hour after taking the placebo, the subjects began to experience the classic symptoms of the actual drug, loss of control, supposed insight into the meaning of existence, and so on. These "placebo trips" lasted several hours.[29]

A few years later, in 1966, the now infamous Harvard psychologist Richard Alpert journeyed to the East to look for holy men who could offer him insight into the LSD experience. He found several who were willing to sample the drug and, interestingly, received a variety of reactions. One pundit told him it was good, but not as good as meditation. Another, a Tibetan lama, complained that it only gave him a headache.

But the reaction that fascinated Alpert most came from a wizened little holy man in the foothills of the Himalayas. Because the man was over sixty, Alpert's first inclination was to give him a gentle dose of 50 to 75 micrograms. But the man was much more interested in one of the 305 microgram pills Alpert had brought with him, a relatively sizable dose. Reluctantly, Alpert gave him one of the pills, but still the man was not satisfied. With a twinkle in his eye he requested another

and then another and placed all 915 micrograms of LSD on his tongue, a massive dose by any standard, and swallowed them (in comparison, the average dose Grof used in his studies was about 200 micrograms).

Aghast, Alpert watched intently, expecting the man to start waving his arms and whooping like a banshee, but instead he behaved as if nothing had happened. He remained that way for the rest of the day, his demeanor as serene and unperturbed as it always was, save for the twinkling glances he occasionally tossed Alpert. The LSD apparently had little or no effect on him. Alpert was so moved by the experience he gave up LSD, changed his name to Ram Dass, and converted to mysticism.[30]

And so taking a placebo may well produce the same effect as taking the real drug, and taking the real drug might produce no effect. This topsy-turvy state of affairs has also been demonstrated in experiments involving amphetamines. In one study, ten subjects were placed in each of two rooms. In the first room, nine were given a stimulating amphetamine and the tenth a sleep-producing barbiturate. In the second room the situation was reversed. In both instances, the person singled out behaved exactly as his companions did. In the first room instead of falling asleep the lone barbiturate taker became animated and speedy, and in the second room the lone amphetamine taker fell asleep.[31] There is also a case on record of a man addicted to the stimulant Ritalin, whose addiction is then transferred to a placebo. In other words, the man's doctor enabled him to avoid all the usual unpleasantries of Ritalin withdrawal by secretly replacing his prescription with sugar pills. Unfortunately the man then went on to display an addiction to the placebo![32]

Such events are not limited to experimental situations. Placebos also play a role in our everyday lives. Does caffeine keep you awake at night? Research has shown that even an injection of caffeine won't keep caffeine-sensitive individuals awake if they believe they are receiving a sedative.[33] Has an antibiotic ever helped you get over a cold or sore throat? If so, you were experiencing the placebo effect. All colds are caused by viruses, as are several types of sore throat, and antibiotics are only effective against bacterial infections, not viral infections. Have you ever experienced an unpleasant side effect after taking a medication? In a study of a tranquilizer called mephenesin, researchers found that 10 to 20 percent of the test subjects experienced negative side effects—including nausea, itchy rash, and heart palpitations—regardless of whether they were given the actual drug

or a placebo.*[34] Similarly, in a recent study of a new kind of chemotherapy, 30 percent of the individuals in the *control* group, the group given placebos, lost their hair.[35] So if you know someone who is taking chemotherapy, tell them to try to be optimistic in their expectations. The mind is a powerful thing.

In addition to offering us a glimpse of this power, placebos also support a more holographic approach to understanding the mind/body relationship. As health and nutrition columnist Jane Brody observes in an article in the *New York Times,* "The effectiveness of placebos provides dramatic support for a 'holistic' view of the human organism, a view that is receiving increasing attention in medical research. This view holds that the mind and body continually interact and are too closely interwoven to be treated as independent entities,"[36]

The placebo effect may also be affecting us in far vaster ways than we realize, as is evidenced by a recent and extremely puzzling medical mystery. If you have watched any television at all in the last year or so, you have no doubt seen a blitzkrieg of commercials promoting aspirin's ability to decrease the risk of heart attack. There is a good deal of convincing evidence to back this up, otherwise television censors, who are real sticklers for accuracy when it comes to medical claims in commercials, wouldn't allow such copy on the air. This is all well and good. The only problem is that aspirin doesn't seem to have the same effect on people in England. A six-year study of 5,139 British doctors revealed no evidence that aspirin reduces the risk of heart attack.[37] Is there a flaw in somebody's research, or is it possible that some kind of massive placebo effect is to blame? Whatever the case, don't stop believing in the prophylactic benefits of aspirin. It still may save your life.

The Health Implications of Multiple Personality

Another condition that graphically illustrates the mind's power to affect the body is Multiple Personality Disorder (MPD). In addition to possessing different brain-wave patterns, the subpersonalities of a multiple have a strong psychological separation from one another.

"Of course I am by M means suggesting that all drug side effects are the result of the placebo effect. Should you experience a negative reaction to a drug, *always* consult a physician.

Each has his own name, age, memories, and abilities. Often each also has his own style of handwriting, announced gender, cultural and racial background, artistic talents, foreign language fluency, and IQ.

Even more noteworthy are the biological changes that take place in a multiple's body when they switch personalities. Frequently a medical condition possessed by one personality will mysteriously vanish when another personality takes over. Dr. Bennett Braun of the International Society for the Study of Multiple Personality, in Chicago, has documented a case in which all of a patient's subpersonafities were allergic to orange juice, except one. If the man drank orange juice when one of his allergic personalities was in control, he would break out in a terrible rash. But if he switched to his nonaliergic personality, the rash would instantly start to fade and he could drink orange juice freely.[38]

Dr. Francine Rowland, a Yale psychiatrist who specializes in treating multiples, relates an even more striking incident concerning one multiple's reaction to a wasp sting. On the occasion in question, the man showed up for his scheduled appointment with Rowland with his eye completely swollen shut from a wasp sting. Realizing he needed medical attention, Howland called an ophthalmologist Unfortunately, the soonest the opthalmologist could see the man was an hour later, and because the man was in severe pain, Howland decided to try something. As it turned out, one of the man's alternates was an "anesthetic personality" who felt absolutely no pain. Howland had the anesthetic personality take control of the body, and the pain ended. But something else also happened. By the time the man arrived at his appointment with the ophthalmologist, the swelling was gone and his eye had returned to normal. Seeing no need to treat him, the ophthalmologist sent him home.

After a while, however, the anesthetic personality relinquished control of the body, and the man's original personality returned, along with all the pain and swelling of the wasp sting. The next day he went back to the ophthalmologist to at last be treated. Neither Howland nor her patient had told the ophthalmologist that the man was a multiple, and after treating him, the ophthalmologist telephoned Howland. "He thought time was playing tricks on him." Rowland laughed. "He just wanted to make sure that I had actually called him the day before and he had not imagined it"[39]

Allergies are not the only thing multiples can switch on and off. If

there was any doubt as to the control the unconscious mind has over drug effects, it is banished by the pharmacological wizardry of the multiple. By changing personalities, a multiple who is drunk can instantly become sober. Different personalities also respond differently to different drugs. Braun records a case in which 5 milligrams of diazepam, a tranquilizer, sedated one personality, while 100 milligrams had little or no effect on another. Often one or several of a multiple's personalities are children, and if an adult personality is given a drug and then a child's personality takes over, the adult dosage may be too much for the child and result in an overdose. It is also difficult to anesthetize some multiples, and there are accounts of multiples wakmg up on the operating table after one of their "unanesthetizable" subpersonalities has taken over.

Other conditions that can vary from personality to personality include scars, burn marks, cysts, and left- and right-handedness. Visual acuity can differ, and some multiples have to carry two or three different pairs of eyeglasses to accommodate their alternating personalities. One personality can be color-blind and another not, and even eye color can change. There are cases of women who have two or three menstrual periods each month because each of their subpersonalities has its own cycle. Speech pathologist Christy Ludlow has found that the voice pattern for each of a multiple's personalities is different, a feat that requires such a deep physiological change that even the most accomplished actor cannot alter his voice enough to disguise his voice pattern.*[0] One multiple, admitted to a hospital for diabetes, baffled her doctors by showing no symptoms when one of her nondiabetic personalities was in control.[41] There are accounts of epilepsy coming and going with changes in personality, and psychologist Robert A. Phillips, Jr., reports that even tumors can appear and disappear (although he does not specify what kind of tumors).[42]

Multiples also tend to heal faster than normal individuals. For example, there are several cases on record of third-degree burns healing with extraordinary rapidity. Most eerie of all, at least one researcher—Dr. Cornelia Wilbur, the therapist whose pioneering treatment of Sybil Dorsett was portrayed in the book *Sybil*—is convinced that multiples don't age as fast as other people.

How could such things be? At a recent symposium on the multiple personality syndrome, a multiple named Cassandra provided a possible answer. Cassandra attributes her own rapid healing ability both to

the visualization techniques she practices and to something she calls *parallel processing.* As she explained, even when her alternate personalities are not in control of her body, they are still aware. This enables her to "think" on a multitude of different channels at once, to do things like work on several different term papers simultaneously, and even "sleep" while other personalities prepare her dinner and clean her house.

Hence, whereas norma! people only do healing imagery exercises two or three times a day, Cassandra does them around the clock. She even has a subpersonality named Celese who possesses a thorough knowledge of anatomy and physiology, and whose sole function is to spend twenty-four hours a day meditating and imaging the body's well-being. According to Cassandra, it is this full-time attention to her health that gives her an edge over normal people. Other multiples have made similar claims.[43]

We are deeply attached to the inevitability of things. If we have bad vision, we believe we will have bad vision for life, and if we suffer from diabetes, we do not for a moment think our condition might vanish with a change in mood or thought. But the phenomenon of multiple personality challenges this belief and offers further evidence of just how much our psychological states can affect the body's biology. If the psyche of an individual with MPD is a kind of multiple image hologram, it appears that the body is one as well, and can switch from one biological state to another as rapidly as the flutter of a deck of cards.

The systems of control that must be in place to account for such capacities is mind-boggling and makes our ability to will away a wart look pale. Allergic reaction to a wasp sting is a complex and multi-faceted process and involves the organized activity of antibodies, the production of histamine, the dilation and rupture of blood vessels, the excessive release of immune substances, and so on. What unknown pathways of influence enable the mind of a multiple to freeze all these processes in their tracks? Or what allows them to suspend the effects of alcohol and other drugs in the blood, or turn diabetes on and off? At the moment we don't know and must console ourselves with one simple fact. Once a multiple has undergone therapy and in some way becomes whole again, he or she can still make these switches at will.'" This suggests that somewhere in our psyches we *all* have the ability to control these things. And still this is not all we can do.

Pregnancy, Organ Transplants, and Tapping the Genetic Level

As we have seen, simple everyday belief can also have a powerful effect on the body. Of course most of us do not have the mental discipline to completely control our beliefs (which is why doctors must use placebos to fool us into tapping the healing forces within us). To regain that control we must first understand the different types of belief that can affect us, for these too offer their own unique window on the plasticity of the mind/body relationship.

CULTURAL BELIEFS

One type of belief is imposed on us by our society. For example, the people of the Trobriand Islands engage freely in sexual relations before marriage, but premarital pregnancy is strongly frowned upon. They use no form of contraception, and seldom if ever resort to abortion. Yet premarital pregnancy is virtually unknown. This suggests that, because of their cultural beliefs, the unmarried women are unconsciously preventing themselves from getting- pregnant.[4S] There is evidence that something similar may be going on in our own culture. Almost everyone knows of a couple who have tried unsuccessfully for years to have a child. They finally adopt, and shortly thereafter the woman gets pregnant. Again this suggests that finally having a child enabled the woman and/or her husband to overcome some sort of inhibition that was blocking the effects of her and/or his fertility.

The fears we share with the other members of our culture can also affect us greatly. In the nineteenth century, tuberculosis killed tens of thousands of people, but starting in the 1880s, death rates began to plummet. Why? Previous to that decade no one knew what caused TB, which gave it an aura of terrifying mystery. But in 1882 Dr. Robert Koch made the momentous discovery that TB was caused by a bacterium. Once this knowledge reached the general public, death rates fell from 600 per 100,000 to 200 per 100,000, despite the fact that it would be nearly half a century before an effective drug treatment could be found.[46]

Fear apparently has been an important factor in the success rates of organ transplants as well. In the 1950s kidney transplants were only a tantalizing possibility. Then a doctor in Chicago made what

seemed to be a successful transplant He published his findings, and soon after other successful transplants took place around the world. Then the first transplant failed. In fact, the doctor discovered that the kidney had actually been rejected from the start. But it did not matter. Once transplant recipients believed they could survive, they did, and success rates soared beyond all expectations.[47]

THE BELIEFS WE EMBODY IN OUR ATTITUDES

Another way belief manifests in our lives is through our attitudes. Studies have shown that the attitude an expectant mother has toward her baby, and pregnancy in general, has a direct correlation with the complications she will experience during childbirth, as well as with the medical problems her newborn infant will have after it is born.[4]* Indeed, in the past decade an avalanche of studies has poured in demonstrating the effect our attitudes have on a host of medical conditions. People who score high on tests designed to measure hostility and aggression are seven times more likely to die from heart problems than people who receive low scores.[49] Married women have stronger immune systems than separated or divorced women, and *happily* married women have even stronger immune systems.[60] People with AIDS who display a fighting spirit live longer than AIDS-infected individuals who have a passive attitude.[51] People with cancer also live longer if they maintain a fighting spirit,[52] Pessimists get more colds than optimists.[53] Stress lowers the immune response;[54] people who have just lost their spouse have an increased incidence of illness and disease,[55] and on and on.

THE BELIEFS WE EXPRESS THROUGH THE POWER OF OUR **WILL**

The types of belief we have examined so far can be viewed largely as passive beliefs, beliefs we allow our culture or the normal state of our thoughts to impose upon us. Conscious belief in the form of a steely and unswerving will can also be used to sculpt and control the body holographic. In the 1970s, Jack Schwarz, a Dutch-born author and lecturer, astounded researchers in laboratories across the United States with his ability to willfully control his body's internal biological processes.

In studies conducted at the Menninger Foundation, the University of California's Langley Porter Neuropsychiatric Institute, and others,

Schwarz astonished doctors by sticking mammoth six-inch sailmaker's needles completely through his arms without bleeding, without flinching, and without producing beta brain waves (the type of brain waves normally produced when a person is in pain). Even when the needles were removed, Schwara still did not bleed, and the puncture holes closed tightly. In addition, Schwarz altered his brain-wave rhythms at will, held burning cigarettes against his flesh without harming himself, and even carried live coals around in his hands. He claims he acquired these abilities when he was in a Nazi concentration camp and had to learn how to control pain in order to withstand the terrible beatings he endured. He believes anyone can learn voluntary control of their body and thus gain responsibility for his or her own health.[55]

Oddly enough, in 1947 another Dutchman demonstrated similar abilities. The man's name was Mirin Dajo, and in public performances at the Corso Theater in Zurich, he left audiences stunned. In plain view Dajo would have an assistant stick a fencing foil completely through his body, clearly piercing vital organs but causing Dajo no harm or pain. Like Schwarz, when the foil was removed, Dajo did not bleed and only a faint red line marked the spot where the foil had entered and exited.

Dajo's performance proved so nerve-racking to his audiences that eventually one spectator suffered a heart attack, and Dajo was legally banned from performing in public. However, a Swiss doctor named Hans Naegeli-Osjord learned of Dajo's alleged abilities and asked him if he would submit to scientific scrutiny. Dajo agreed, and on May 31, 1947, he entered the Zurich cantonal hospital. In addition to Dr. Naegeli-Osjord, Dr. Werner Brunner, the chief of surgery at the hospital, was also present, as were numerous other doctors, students, and journalists. Dajo bared his chest and concentrated, and then, in full view of the assemblage, he had his assistant plunge the foil through his body.

As always, no blood flowed and Dajo remained completely at ease. But he was the only one smiling. The rest of the crowd had turned to stone. By all rights, Dajo's vital organs should have been severely damaged, and his seeming good health was almost too much for the doctors to bear. Filled with disbelief, they asked Dajo if he would submit to an X ray. He agreed and without apparent effort accompanied them up the stairs to the X-ray room, the foil still through his abdomen. The X ray was taken and the result was undeniable. Dajo was indeed impaled. Finally, a full twenty minutes after he had been

pierced, the foil was removed, leaving only two faint scars. Later, Dajo was tested by scientists in Basel, and even let the doctors themselves run him through with the foil. Dr. Naegeli-Osjord later related the entire case to the German physicist Alfred Stelter, and Stelter reports it in his book *Psi-Heating.*[S7]

Such supernormal feats of control are not limited to the Dutch. In the 1960s Gilbert Grosvenor, the president of the National Geographic Society, his wife, Donna, and a team of *Geographic* photographers visited a village in Ceylon to witness the alleged miracles of a local wonderworker named Mohotty. It seems that as a young boy Mohotty prayed to a Ceylonese divinity named Kataragama and told the god that if he cleared Mohotty's father of a murder charge, he, Mohotty, would do yearly penance in Kataragama's honor. Mohotty's father was cleared, and true to his word, every year Mohotty did his penance.

This consisted of walking through fire and hot coals, piercing his cheeks with skewers, driving skewers into his arms from shoulder to wrist, sinking large hooks deep into his back, and dragging an enormous sledge around a courtyard with ropes attached to the hooks. As the Grosvenors later reported, the hooks pulled the flesh in Mohotty's back quite taut, and again there was no sign of blood. When Mohotty was finished and the hooks were removed, there weren't even any traces of wounds. The *Geographic* team photographed this unnerving display and published both pictures and an account of the incident in the April 1966 issue of *National Geographic.*™

In 1967 *Scientific American* published a report about a similar annual ritual in India. In that instance a *different* person was chosen each year by the local community, and after a generous amount of ceremony, two hooks large enough to hang a side of beef on were buried in the victim's back. Ropes that were pulled through the eyes of the hooks were tied to the boom of an ox cart, and the victim was then swung in huge ares over the fields as a sacramental offering to the fertility gods. When the hooks were removed the victim was completely unharmed, there was no blood, and literally no sign of any punctures in the flesh itself.[59]

OUR UNCONSCIOUS BELIEFS

As we have seen, if we are not fortunate enough to have the self-mastery of a Dajo or a Mohotty, another way of accessing the healing force within us is to bypass the thick armor of doubt and skepticism

that exists in our conscious minds. Being tricked with a placebo is one way of accomplishing this. Hypnosis is another. Like a surgeon reaching in and altering the condition of an internal organ, a skilled hypnotherapist can reach into our psyche and help us change the most important type of belief of all, our unconscious beliefs.

Numerous studies have demonstrated irrefutably that under hypnosis a person can influence processes usually considered unconscious. For instance, like a multiple, deeply hypnotized persons can control allergic reactions, blood flow patterns, and nearsightedness. In addition, they can control heart rate, pain, body temperature, and even will away some kinds of birthmarks. Hypnosis can also be used to accomplish something that, in its own way, is every bit as remarkable as suffering no injury after a foil has been stuck through one's abdomen.

That something involves a horribly disfiguring hereditary condition known as Brock's disease. Victims of Brocq's disease develop a thick, horny covering over their skin that resembles the scales of a reptile. The skin can become so hardened and rigid that even the slightest movement will cause it to crack and bleed. Many of the so-called alligator-skinned people in circus sideshows were actually individuals with Brocq's disease, and because of the risk of infection, victims of Brocq's disease used to have relatively short lifespans.

Brocq's disease was incurable until 1951 when a sixteen-year-old boy with an advanced case of the affliction was referred as a last resort to a hypnotherapist named A. A. Mason at the Queen Victoria Hospital in London. Mason discovered that the boy was a good hypnotic subject and could easily be put into a deep state of trance. While the boy was in trance, Mason told him that his Brocq's disease was healing and would soon be gone. Five days later the scaly layer covering the boy's left arm fell off, revealing soft, healthy flesh beneath. By the end of ten days the arm was completely normal. Mason and the boy continued to work on different body areas until all of the scaly skin was gone. The boy remained symptom-free *for* at least five years, at which point Mason lost touch with him.[00]

This is extraordinary because Brocq's disease is a genetic condition, and getting rid of it involves more than just controlling autonomic processes such as blood flow patterns and various cells of the immune system. It means tapping into the masterplan, our DN A programming itself. So, it would appear that when we access the right strata of our beliefs, our minds can override even our genetic makeup.

FIGURE 11. A 1962 X ray showing the degree to which Vittorio Michelli's hip bone had disintegrated as a result of his malignant sarcoma. So littie bone was left that the ball of his upper leg was free-floating in a mass of soft tissue, rendered as gray mist in the X ray.

FIGURE 12. After a series of baths in the spring at Lourdes, Michelli experienced a miraculous healing. His hip bone completely regenerated over the course of several months, a feat currently considered impossible by medical science. This 1965 X ray shows his miraculously restored hip joint. [Source: Michel-Marie Salmon, *The Extraordinary Cure of Vittorio Michelli.* Used by permission]

THE BELIEFS EMBODIED IN OUR FAITH

Perhaps the most powerful types of belief of all are those we express through spiritual faith. In 1962 a man named Vittorio Michelli was admitted to the Military Hospital of Verona, Italy, with a large cancerous tumor on his left hip (see fig. 11). So dire was his prognosis that he was sent home without treatment, and within ten months his hip had completely disintegrated, leaving the bone of his upper leg floating in nothing more than a mass of soft tissue. He was, quite literally, falling apart As a last resort he traveled to Lourdes and had himself bathed in the spring (by this time he was in a plaster cast, and his movements were quite restricted). Immediately on entering the water he had a sensation of heat moving through his body. After the bath his appetite returned and he felt renewed energy. He had several more baths and then returned home.

Over the course of the next month he felt such an increasing sense of well-being he insisted his doctors X-ray him again. They discovered his tumor was smaller. They were so intrigued they documented every step in this improvement. It was a good thing because after Michelli's tumor disappeared, his bone began to regenerate, and the medical community generally views this as an impossibility. Within two months he was up and walking again, and over the course of the next several years his bone completely reconstructed itself (see fig. 12).

A dossier on Michelli's case was sent to the Vatican's Medical Commission, an international panel of doctors set up to investigate such matters, and after examining the evidence the commission decided Michelli had indeed experienced a miracle. As the commission stated in its official report, "A remarkable reconstruction of *the iliac* bone and cavity has taken place. The X rays made in 1964,1965,1968 and 1969 confirm categorically and without doubt that an unforeseen and even overwhelming bone reconstruction has taken place of a type unknown in the annals of world medicine."*[61]

Was Michelli's healing a miracle in the sense that it violated any of the known laws of physics? Although the jury remains out on this question, there seems no clear-cut reason to believe any laws were

'In a truly stunning example of synchronicity, while I was in the middle of writing these very words a letter armed in the mail informing me that a friend who lives in Kauai, Hawaii, and whose hip had disintegrated due to cancer has also experienced an "inexplicable" and complete regeneration of her bone. The tools she employed to effect her recovery were chemotherapy, extensive meditation, and imagery exercises. The story of her healing has been reported in the Hawaiian newspapers.

violated. Rather, Michelli's healing may simply be due to natural processes we do not yet understand. Given the phenomenal range of healing capacities we have looked at so far, it is clear there are many pathways of interaction between the mind and body that we do not yet understand.

If Michelli's healing was attributable to an undiscovered natural process, we might better ask, Why is the regeneration of bone so rare and what triggered it in Michelli's case? It may be that bone regeneration is rare because achieving it requires the accessing of very deep levels of the psyche, levels usually not reached through the normal activities of consciousness. This appears to be why hypnosis is needed to bring about a remission of Brocq's disease. As for what triggered Michelli's healing, given the role belief plays in so many examples of mind/body plasticity it is certainly a primary suspect. Could it be that through his faith in the healing power of Lourdes, Michelli somehow, either consciously or serendipitously, effected his own cure?

There is strong evidence that belief, not divine intervention, is the prime mover in at least some so-called miraculous occurrences. Recall that Mohotty attained his supernormal self-control by praying to Kata-ragama, and unless we are willing to accept the existence of Katara-gama, Mohotty*s abilities seem better explained by his deep and abiding *belief* that he was divinely protected. The same seems to be true of many miracles produced by Christian wonder-workers and saints.

One Christian miracle that appears to be generated by the power of the mind is stigmata. Most church scholars agree that St. Francis of Assisi was the first person to manifest spontaneously the wounds of the crucifixion, but since his death there have been literally hundreds of other stigmatists. Although no two ascetics exhibit the stigmata in quite the same way, all have one thing in common. From St. Francis on, all have had wounds on their hands and feet that represent where Christ was nailed to the cross. This is not what one would expect if stigmata were God-given. As parapsychologist D. Scott Rogo, a member of the graduate faculty at John F. Kennedy University in Orinda, California, points out, it was Roman custom to place the nails through the *wrists,* and skeletal remains from the time of Christ bear this out Nails inserted through the hands cannot support the weight of a body hanging on a cross.[62]

Why did St. Francis and all the other stigmatists who came after him believe the nail holes passed through the hands? Because that is the way the wounds have been depicted by artists since the eighth century. That the position and even size and shape of stigmata have been influenced by art is especially apparent in the case of an Italian stigma-tist named Gemma Galgani, who died in 1903. Gemma's wounds precisely mirrored the stigmata on her own favorite crucifix.

Another researcher who believed stigmata are self-induced was Herbert Thurston, an English priest who wrote several volumes on miracles. In his tour de force *The Physical Phenomena of Mysticism,* published posthumously in 1952, he listed several reasons why he thought stigmata were a product of autosuggestion. The size, shape, and location of the wounds varies from stigmatist to stigmatist, an inconsistency that indicates they are not derived from a common source, i.e., the actual wounds of Christ. A comparison of the visions experienced by various stigmatists also shows little consistency, suggesting that they are not reenactments of the historical crucifixion, but are instead products of the stigmatists' own minds. And perhaps most significant of all, a surprisingly large percentage of stigmatists also suffered from hysteria, a fact Thurston interpreted as a further indication that stigmata are the side effect of a volatile and abnormally emotional psyche, and not necessarily the product of an enlightened one.[63] In view of such evidence it is small wonder that even some of the more liberal members of the Catholic leadership believe stigmata are the product of "mystical contemplation," that is, that they are *created* by the mind during periods of intense meditation.

If stigmata are products of autosuggestion, the range of control the mind has over the body holographic must be expanded even further. Like Mohotty's wounds, stigmata can also heal with disconcerting speed. The almost limitless plasticity of the body is further evidenced in the ability of some stigmatists to grow nail-like protuberances in the middle of their wounds. Again, St. Francis was the first to display this phenomenon. According to Thomas of Celano, an eyewitness to St. Francis's stigmata and also his biographer: "His hands and feet seemed pierced in the midst by nails. These marks were round on the inner side of the hands and elongated on the outer side, and certain small pieces of flesh were seen like the ends of nails bent and driven back, projecting from the rest of the flesh."[64]

Another contemporary of St. Francis's, St Bonaventura, also witnessed the saint's stigmata and said that the nails were so clearly defined one could slip a finger under them and into the wounds. Although St. Francis's nails appeared to be composed of blackened and hardened flesh, they possessed another naillike quality. According to

Thomas of Celano, if a iiaiJ were pressed on one side, it instantly projected on the other side, just as it would if it were a real nail being slid back and forth through the middle of the hand!

Therese Neumann, the well-known Bavarian stigmatist who died in 1962, also had such naillike protuberances. Like St. Francis's they were apparently formed of hardened skin. They were thoroughly examined by several doctors and found to be structures that passed completely through her hands and feet. Unlike St. Francis's wounds, which were open continuously, Neumann's opened only periodically, and when they stopped bleeding, a soft, membranelike tissue quickly grew over them.

Other stigmatists have displayed similarly profound alterations in their bodies. Padre Pio, the famous Italian stigmatist who died in 1968, had stigmata wounds that passed completely through his hands. A wound in his side was so deep that doctors who examined it were afraid to measure it for fear of damaging his internal organs. Venerable Giovanna Maria Solimani, an eighteenth-century Italian stigmatist, had wounds in her hands deep enough to stick a key into. As with all stigmatists' wounds, bers never became decayed, infected, or even inflamed. And another eighteenth-century stigmatist, St. Veronica Giuliani, an abbess at a convent in Citta di Castello in Umbria, Italy, had a large wound in her side that *would open and close on command.*

Images Projected Outside the Brain

The holographic model has aroused the interest of researchers in the Soviet Union, and two Soviet psychologists, Dr. Alexander P. Dubrov and Dr. Veniamin N. Pushkin, have written extensively on the idea. They believe that the frequency processing capabilities of the brain do not in and of themselves prove the holographic nature of the images and thoughts in the human mind. They have, however, suggested what might constitute such proof. Dubrov and Pushkin believe that if an example could be found where the brain projected an image outside of itself, the holographic nature of the mind would be convincingly demonstrated. Or to use their own words, "Records of ejection of psychophysical structures outside the brain would provide direct evidence of brain holograms."[65]

In fact, St. Veronica Giuliani seems to supply such evidence. During

the last years of her life she became convinced that the images of the Passion—a crown of thorns, three nails, a cross, and a sword—had become emblazoned on her heart. She drew pictures of these and even noted where they were located. After she died an autopsy revealed that the symbols were indeed impressed on her heart exactly as she had depicted them. The two doctors who performed the autopsy signed sworn statements attesting to their finding.[66]

Other stigmatists have had similar experiences. St. Teresa of Avila had a vision of an angel piercing her heart with a sword, and after she died a deep fissure was found in her heart. Her heart, with the miraculous sword wound still clearly visible, is now on display as a relic in Alba de Tormes, Spain.[67] A nineteenth-century French stigmatist named Marie-Julie Jahenny kept seeing the image of a flower in her mind, and eventually a picture of the flower appeared on her breast. It remained there twenty years.[6"] Nor are such abilities limited to stigmatists. In 1913 a twelve-year-old girl from the village of Bussus-Bus-Suel, near Abbeville, France, made headlines when it was discovered that she could consciously command images, such as pictures of dogs and horses, to appear on her arms, legs, and shoulders. She could also produce words, and when someone asked her a question the answer would instantly appear *on her* skin.[69]

Surely such demonstrations are examples of the ejection of psychophysical structures outside the brain. In fact, in a way stigmata themselves, especially those in which the flesh has formed into nail-like protrusions, are examples of the brain projecting images outside itself and impressing them in the soft clay of the body holographic. Dr. Michael Grosso, a philosopher at Jersey City State College who has written extensively on the subject of miracles, has also arrived at this conclusion. Grosso, who traveled to Italy to study Padre Pio's stigmata firsthand, states, "One of the categories in my attempt to analyze Padre Pio is to say that he had an ability to symbolically transform physical reality. In other words, the level of consciousness he was operating at enabled him to transform physical reality in the light of certain symbolic ideas. For example, he identified with the wounds of the crucifixion and his body became permeable to those psychie symbols, gradually assuming their form."™

So it appears that through the use of images, the brain can tell the body what to do, including telling it to make more images. Images making images. Two mirrors reflecting each other infinitely. Such is the nature of the mind/body relationship in a holographic universe.

Laws Both Known and Unknown

At the beginning of this chapter, I said that instead of examining the various mechanisms the mind uses to control the body, the chapter would be devoted primarily to exploring the range of this control. In doing so I did not mean to deny or diminish the importance of such mechanisms. They are crucial to our understanding of the mind/ body relationship, and new discoveries in this area seem to appear every day.

For example, at a recent conference on psychoneuroimmunology—a new science that studies the way the mind (psycho), the nervous system (neuro), and the immune system (immunology) interact—Candace Pert, chief of brain biochemistry at the National Institute of Mental Health, announced that immune cells have neuropeptide receptors. Neuropeptides are molecules the brain uses to communicate, the brain's telegrams, if you will. There was a time when it was believed that neuropeptides could only be found in the brain. But the existence of receptors (telegram receivers) on the cells in our immune system implies that the immune system is not separate from but is an extension of the brain. Neuropeptides have also been found in various other parts of the body, leading Pert to admit that she can no longer tell where the brain leaves off and the body begins.[71]

I have excluded such particulars, not only because 1 felt examining the extent to which the mind can shape and control the body was more relevant to the discussion at hand, but also because the biological processes responsible for mind/body interactions are too vast a subject for this book. At the beginning of the section on miracles I said there was no clear-cut reason to believe Michelli's bone regeneration could not be explained by our current understanding of physics. This is less true of stigmata. It also appears to be very much not true of various paranormal phenomena reported by credible individuals throughout history, and in recent times by various biologists, physicists, and other researchers.

In this chapter we have looked at astounding things the mind can do that, although not fully understood, do not seem to violate any of the known laws of physics. In the next chapter we will look at some of the things the mind can do that cannot be explained by our current scientific understandings. As we will see, the holographic idea may shed light in these areas as well. Venturing into these territories will

occasionally involve treading on what might at first seem to be shaky ground and examining phenomena even more dizzying and incredible than Mohotty's rapidly healing wounds and the images on St. Veronica Giuliani's heart. But again we will find that, despite their daunting nature, science is also beginning to make inroads into these territories.

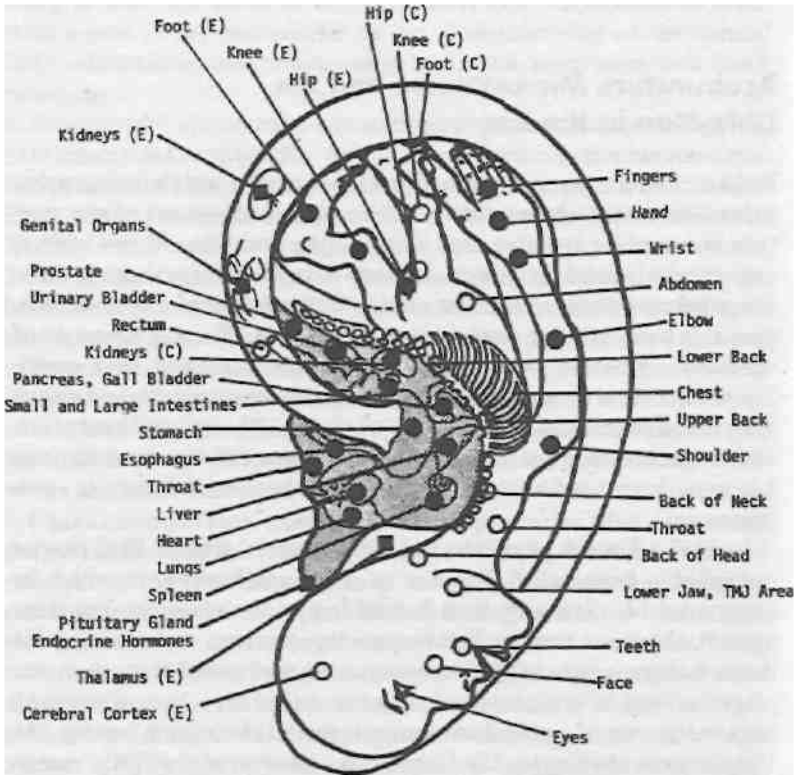
Acupuncture Microsystems and the Little Man in the Ear

Before closing, one last piece of evidence of the body's holographic nature deserves to be mentioned. The ancient Chinese art of acupuncture is based on the idea that every organ and bone in the body is connected to specific points on the body's surface. By activating these acupuncture points, with either needles or some other form of stimulation, it is believed that diseases and imbalances affecting the parts of the body connected to the points can be alleviated and even cured. There are over a thousand acupuncture points organized in imaginary lines called meridians on the body's surface. Although still controversial, acupuncture is gaining acceptance in the medical community and has even been used successfully to treat chronic back pain in racehorses.

In 1957 a French physician and acupuncturist named Paul Nogier published a book called *Treatise of Auriculotkerapy,* in which he announced his discovery that in addition to the major acupuncture system, there are two smaller acupuncture systems on both ears. He dubbed these *acupuncture microsystems* and noted that when one played a kind of connect-the-dots game with them, they formed an anatomical map of a miniature human inverted like a fetus (see fig. 13). Unbeknownst to Nogier, the Chinese had discovered the "little man in the ear" nearly 4,000 years earlier, but a map of the Chinese ear system wasn't published until after Nogier had already laid claim to the idea.

The little man in the ear is not just a charming aside in the history of acupuncture. Dr. Terry Oleson, a psycho biologist at the Pain Management Clinic at the University of California at Los Angeles School of Medicine, has discovered that the ear microsystem can be used to diagnose accurately what's going on in the body. For instance, Oleson

has discovered that increased electrical activity in one of the acupuncture points in the ear generally indicates a pathological condition (either past or present) in the corresponding area of the body. In one study, forty patients were examined to determine areas of their body where they experienced chronic pain. Following the examination, each



C ■ Chinese Ear Acupuncture Systoi

E » European AiiHculotherapy Systen

FIGURE 13. The Little Man in the Ear. Acupuncturists have found that the acupuncture points in the ear form the outline of a miniature human being. Dr. Terry Oleson, a psychobiologist at UCLA's School of Medicine, believes it is because the body is a hologram and each of its portions contains an image of the whole. [Copyright Dr. Terry Oleson, UCLA School of Medicine. Used by permission]

patient was draped in a sheet to conceal any visible problems. Then an acupuncturist with no knowledge of the results examined only their ears. When the results were tallied it was discovered that the ear examinations were in agreement with the established medical diagnoses 75.2 percent of the time.[72]

Ear examinations can also reveal problems with the bones and internal organs. Once when Oleson was out boating with an acquaintance he noticed an abnormally flaky patch of skin in one of the man's ears. From his research Oleson knew the spot corresponded to the heart, and he suggested to the man that he might want to get his heart checked. The man went to his doctor the next day and discovered he had a cardiac problem which required immediate open-heart surgery.[73]

Oleson also uses electrical stimulation of the acupuncture points in the ear to treat chronic pain, weight problems, hearing loss, and virtually all kinds of addiction. In one study of 14 narcotic-addicted individuals, Oleson and his colleagues used ear acupuncture to eliminate the drug requirements of 12 of them in an average of 5 days and with only minimal withdrawal symptoms/[4] Indeed, ear acupuncture has proved so successful in bringing about rapid narcotic detoxification that clinics in both Los Angeles and New York are now using the technique to treat street addicts.

Why would the acupuncture points in the ear be aligned in the shape of a miniature human? Oleson believes it is because of the holographic nature of the mind and body. Just as every portion of a hologram contains the image of the whole, every portion of the body may also contain the image of the whole. "The ear holograph is, logically, connected to the brain holograph which itself is connected to the whole body," he states. "The way we use the ear to affect the rest of the body is by working through the brain holograph."[75]

Oleson believes there are probably acupuncture microsystems in other parts of the body as well. Dr. Ralph Alan Dale, the director of the Acupuncture Education Center in North Miami Beach, Florida, agrees. After spending the last two decades tracking down clinical and research data from China, Japan, and Germany, he has accumulated evidence of eighteen different microacupuncture holograms in the body, including ones in the hands, feet, arms, neck, tongue, and even the gums. Like Oleson, Dale feels these microsystems are "holographic reiterations of the gross anatomy," and believes there are still other such systems waiting to be discovered. In a notion reminiscent of Bohm's assertion that every electron in some way contains the

cosmos, Dale hypothesizes that every finger, and even every cell, may contain its own acupuncture microsystem.[76]

Richard Leviton, a contributing editor at *East West* magazine, who has written about the holographic implications of acupuncture microsystems, thinks that alternative medical techniques—such as reflexology, a type of massage therapy that involves accessing all points of the body through stimulation of the feet, and iridology, a diagnostic technique that involves examining' the iris of the eye in order to determine the condition of the body—may also be indications of the body's holographic nature. Leviton concedes that neither field has been experimentally vindicated {studies of iridology, in particular, have produced extremely conflicting results) but feels the holographic idea offers a way of understanding them if their legitimacy is established.

Leviton thinks there may even be something to palmistry. By this he does not mean the type of hand reading practiced by fortune-tellers who sit in glass storefronts and beckon people in, but the 4,500-year-old Indian version of the science. He bases this suggestion on his own profound encounter with an Indian hand reader living in Montreal who possessed a doctorate in the subject from Agra University, India. "The holographic paradigm provides palmistry's more esoteric and controversial claims a context for validation," says Leviton.[77]

It is difficult to assess the type of palmistry practiced by Leviton's Indian hand reader in the absence of double-blind studies, but science is beginning to accept that at least some information about our body ts contained in the lines and whorls of our hand. Herman Weinreb, a neurologist at New York University, has discovered that a fingerprint pattern called an *ulnar loop* occurs more frequently in Alzheimer's

FIGURE 14. Neurologists have found that Alzheimer's patients have a more than average chance of having a distinctive fingerprint pattern known as an *ulnar loop.* At least ten other common genetic disabilities are also associated with various patterns in the hand. Such findings may provide evidence of the holographic model's assertion that every portion of the body contains information about the whole. [Redrawn by the author from original art in *Medicine* magazine]

patients than in nonsufferers (see fig. 14). In a study of 50 Alzheimer's patients and 50 normal individuals, 72 percent of the Alzheimer's group had the pattern on at least 8 of their fingertips, compared to only 26 percent in the control group. Of those with ulnar loops on all 10 fingertips, 14 were Alzheimer's sufferers, but only 4 members of the control group had the pattern.[78]

It is now known that 10 common genetic disabilities, including Down's syndrome, are also associated with various patterns in the hand. Doctors in West Germany are now using this information to analyze parents' hand prints and help determine whether expectant mothers should undergo amniocentesis, a potentially dangerous genetic screening procedure in which a needle is inserted into the womb to draw off amniotic fluid for laboratory testing.

Researchers at West Germany's Institute of Dermatoglyphks in Hamburg have even developed a computer system that uses an opto-electric scanner to take a digitized "photo" of a patient's hand. It then compares the hand to the 10,000 other prints in its memory, scans it for the nearly 50 distinctive patterns now known to be associated with various hereditary disabilities, and quickly calculates the patient's risk factors.[78] So perhaps we should not be so quick to dismiss palmistry out of hand. The lines and whorls in our palms may contain more about our whole self than we realize.

Harnessing the Powers of the Holographic Brain

Throughout this chapter two broad messages come through loud and clear. According to the holographic model, the mind/body ultimately cannot distinguish the difference between the neural holograms the brain uses to experience reality and the ones it conjures up while imagining reality. Both have a dramatic effect on the human organism, an effect so powerfu! that *it* can modulate the immune system, duplicate and/or negate the effects of potent drugs, heal wounds with amazing rapidity, melt tumors, override our genetic programming, and reshape our living flesh in ways that almost defy belief. This then is the first message: that each of us possesses the ability, at least at some level, to influence our health and control our physical form in ways that are nothing short of dazzling. We are all potential wonderworkers, dormant yogis, and it is clear from the evidence presented

in the preceding pages that it would behoove us both as individuals and as a species to devote a good deal more effort into exploring and harnessing these talents.

The second message is that elements that go into the making of these neural holograms are many and subtle. They include the images upon which we meditate, our hopes and fears, the attitudes of our doctors, our unconscious prejudices, our individual and cultural beliefs, and our faith in things both spiritual and technological. More than just facts, these are important clues, signposts that point toward those things that we must become aware of and acquire mastery over if we are to learn how to unleash and manipulate these talents. There are, no doubt, other factors involved, other influences that shape and circumscribe these abilities, for one thing should now be obvious. In a holographic universe, a universe in which a slight change in attitude can mean the difference between life and death, in which things are so subtly interconnected that a dream can call forth the inexplicable appearance of a scarab beetle, and the factors responsible for an illness can also evoke a certain pattern in the lines and whorls of the hand, we have reason to suspect that each effect has multitudinous causes. Each linkage is the starting point of a dozen more, for in the words of Walt Whitman, "A vast similitude interlocks ail."

5

A Pocketful of Miracles

Miracles happen, not in opposition to Nature, but in opposition to what we know of Nature.

—St. Augustine

Every year in September and May a huge crowd gathers at the Duomo San Gennaro, the principal cathedral of Naples, to witness a miracle. The miracle involves a small viai containing a brown crusty substance alleged to be the biood of San Gennaro, or St. Januarius, who was beheaded by the Roman emperor Diocletian in A.D. 305. According to legend, after the saint was martyred a serving woman collected some of his blood as a reJic. No *one* knows precisely what happened after that, save that the blood didn't turn up again until the end of the thirteenth century when it was ensconced in a silver reliquary in the cathedral.

The miracle is that twice yearly, when the crowd shouts at the vial, the brown crusty substance changes into a bubbling, bright red liquid. There is little doubt that the liquid is real blood. In 1902 a group of scientists from the University of Naples made a spectroscopic analysis of the liquid by passing a beam of light through it, verifying that it was blood. Unfortunately, because the reliquary containing the blood is so old and fragile, the church will not allow it to be cracked open

so that other tests can be done, and so the phenomenon has never been thoroughly studied.

But there is further evidence that the transformation is a more than ordinary event. Occasionally throughout history (the first written account of the public performance of the miracle dates back to 1389) when the vial is brought out, the blood refuses to liquefy. Although rare, this is considered a very bad omen by the citizens of Naples. In the past, the failure of the miracle has directly preceded the eruption of Vesuvius and the Napoleonic invasion of Naples. More recently, in 1976 and 1978, it presaged the worst earthquake in Italian history and the election of a communist city government in Naples, respectively.

Is the liquefaction of San Gennaro's blood a miracle? It appears to be, at least in the sense that it seems impossible to explain by known scientific laws. Is the liquefaction caused by San Gennaro himself? My own feeling is that its more likely cause is the intense devotion and belief of the people witnessing the miracle. I say this because nearly all of the miracles performed by saints and wonder-workers of the world's great religions have also been duplicated by psychics. This suggests that, as with stigmata, miracles are produced by forces lying deep in the human mind, forces that are latent in all of us. Herbert Thurston, the priest who wrote *The Physical Phenomena of Mysticism,* himself was aware of this similarity and was reluctant to attribute any miracle to a truly supernatural cause {as opposed to a psychic or paranormal cause). Another piece of evidence supportive of this idea is that many stigmatists, including Padre Pio and Therese Neumann, were also renowned for their psychic abilities.

One psychic ability that appears to play a role in miracles is psychokinesis or PK. Since the miracle of San Gennaro involves a physical alteration of matter, PK is certainly a likely suspect. Rogo believes PK is also responsible for some of the more dramatic aspects of stigmata. He feels that it is well within the normal biological capabilities of the body to cause small blood vessels under the skin to break and produce superficial bleeding, but only PK can account for the rapid appearance of large wounds.[1] Whether this is true or not remains to be seen, but PK is clearly a factor in some of the phenomena that accompany stigmata. When blood flowed from the wounds in Therese Neumann's feet, it always flowed toward her toes—exactly as it would have flowed from Christ's wounds when he was on the cross—regardless of how her feet were positioned. This meant that when she was sitting upright in bed, the blood actually flowed *upward and counter to the force of gravity.* This was observed by numerous witnesses, including many U.S. servicemen stationed in Germany after the war who visited Neumann to witness her miraculous abilities. Gravity-defying flows of blood have been reported in other cases of stigmata as well.[2]

Such events leave us agog because our current worldview does not provide us with a context with which to understand PK. Bohm believes viewing the universe as a holomovement does provide us with a context. To explain what he means he asks us to consider the following situation. Imagine you are walking down a street late one night and a shadow suddenly looms up out of nowhere. Your first thought might be that the shadow is an assailant and you are in danger. The information contained in this thought will in turn give rise to a range of imagined activities, such as running, being hurt, and fighting. The presence of these imagined activities in your mind, however, is *not* a purely "mental" process, for they are inseparable from a host of related biological processes, such as excitation of nerves, rapid heart beat, release of adrenaline and other hormones, tensing of the muscles, and so on. Conversely, if your first thought is that the shadow is just a shadow, a different set of mental and biological responses will follow. Moreover, a little reflection will reveal that we react both mentally and biologically to everything we experience.

According to Bohm, the important point to be gleaned from this is that consciousness is not the only thing that can respond to *meaning.* The body can also respond, and this reveals that meaning is simultaneously both mental and physical in nature. This is odd, for we normally think of meaning as something that can only have an active effect on subjective reality, on the thoughts inside our heads, not something that can engender a response in the physical world of things and objects. Meaning "can thus serve as the link or 'bridge' between these two sides of reality," Bohm states. "This link is indivisible in the sense that information contained in thought, which we feel to be on the 'mental' side, is at the same time a neurophysiological, chemical, and physical activity, which is clearly what is meant by this thought on the 'material' side."[3]

Bohm feels that examples of objectively active meaning can be found in other physical processes. One is the functioning of a computer chip. A computer chip contains information, and the meaning of the information is active in the sense that it determines how electrical currents flow through the computer. Another is the behavior of subatomic particles. The orthodox view in physics is that quantum waves

act mechanically on a particle, controlling its movement in much the same way that the waves of the ocean might control a Ping-Pong ball floating on its surface. But Bohm does not feel that this view can explain, for example, the coordinated dance of electrons in a plasma any more than the wave motion of water could explain a similarly well-choreographed movement of Ping-Pong balls if such a movement were discovered on the ocean's surface. He believes the relationship between particle and quantum wave is more like a ship on automatic pilot guided by radar waves. A quantum wave does not push an electron about any more than a radar wave pushes a ship. Rather, it provides the electron with *information* about its environment which the electron then uses to maneuver on its own.

In other words, Bohm believes that an electron is not only mindiike, but is a highly complex entity, a far cry from the standard view that an electron is a simple, structureless point. The active use of information by electrons, and indeed by all subatomic particles, indicates that the ability to respond to meaning is a characteristic not only of consciousness but of all matter. It is this intrinsic commonality, says Bohm, that offers a possible explanation for PK. He states, "On this basis, psychokinesis could arise if the mental processes of one or more people were focused on meanings that were in harmony with those guiding the basic processes of the material systems in which this psychokinesis was to be brought about'"[1]

It is important to note that this kind of psychokinesis would not be due to a causal process, that is, a cause-and-effect relationship involving any of the known forces in physics. Instead, it would be the result of a kind of nonlocal "resonance of meanings," or a kind of nonlocal interaction similar to, but not the same as, the nonlocal interconnection that allows a pair of twin photons to manifest the same angle of polarization which we saw in chapter 2 (for technical reasons Bohm believes mere quantum nonlocality cannot account for either PK or telepathy, and only a deeper form of nonlocality, a kind of "super" nonlocality, would offer such an explanation).

The Gremlin in the Machine

Another researcher whose ideas about PK are similar to Bohm's, but who has taken them one step further, is Robert G. Jahn, a professor

of aerospace sciences and dean emeritus of the School of Engineering and Applied Science at Princeton University. Jahn's involvement in the study of PK happened quite by accident. A former consultant for both NASA and the Department of Defense, his original field of interest was deep spaee propulsion. In fact, he is the author of *Physics of Electric Propulsion,* the leading textbook in the field, and didn't even believe in the paranormal when a student first approached him and asked him to oversee a PK experiment she wanted to do as an independent study project. Jahn reluctantly agreed, and the results were so provocative they inspired him to found the Princeton Engineering Anomalies Research (PEAR) lab in 1979. Since then PEAR researchers have not only produced compelling evidence of the existence of PK, but have gathered more data on the subject than anyone else in the country.

In one series of experiments Jahn and his associate, clinical psychologist Brenda Dunne, employed a device called a random event generator, or REG, By relying on an unpredictable natural process such as radioactive decay, a REG is able to produce a string of random binary numbers. Such a string might look something like this: 1, 2, 1, 2, 2, 1, 1, 2, 1, 1, 1, 2, I. In other words, a REG is a kind of automatic coin-flipper capable of producing an enormous number of coin flips in a very short time. As everyone knows, if you flip a perfectly weighted coin 1,000 times, the odds are you will get a 50/50 split between heads and tails. In reality, out of any 1,000 such flips, the split may vary a little in one direction or the other, but the greater the number of flips, the closer to 50/50 the split will become.

What Jahn and Dunne did was have volunteers sit in front of the REG and concentrate on having it produce an abnormally large number of either heads or tails. Over the course of literally hundreds of thousands of trials they discovered that, through concentration alone, the volunteers did indeed have a small but statistically significant effect on the REG's output. They discovered two other things as well. The ability to produce PK effects was not limited to a few gifted individuals but was present in the majority of volunteers they tested. This suggests that most of us possess some degree of PK. They also discovered that different volunteers produced different and consistently distinctive results, results that were so idiosyncratic that Jahn and Dunne started calling them "signatures."[5]

In another series of experiments Jahn and Dunne employed a pinball-like device that allows 9,000 three-quarter-inch marbles to cir-

culate around 330 nylon pegs and distribute themselves into 19 collecting bins at the bottom. The device is contained in a shallow vertical frame ten feet high and six feet wide with a clear glass front so that volunteers can see the marbles as they fall and collect, in the bins. Normally, more balis fall in the center bins than in the outer ones, and the overall distribution looks like a bell-shaped curve.

As with the REG, Jahn and Dunne had volunteers sit in front of the machine and try to make more balls land in the outer bins than in the center ones. Again, over the course of a large number of runs, the operators were able to create a small but measurable shift in where the balls landed. In the REG experiments the volunteers only exerted a PK effect on microscopic processes, the decay of a radioactive substance, but the pinball experiments revealed that test subjects could use PK to influence objects in the everyday world as well. What's more, the "signatures" of individuals who had participated in the REG experiments surfaced again in the pinball experiments, suggesting that the PK abilities of any given individual remain the same from experiment to experiment, but vary from individual to individual just as other talents vary. Jahn and Dunne state, "While small segments of these results might reasonably be discounted as falling too close to chance behavior to justify revision of prevailing scientific tenets, taken in concert the entire ensemble establishes an incontrovertible aberration of substantial proportions."[6]

Jahn and Dunne think their findings may explain the propensity some individuals seem to have for jinxing machinery and causing equipment to malfunction. One such individual was physicist Wolfgang Pauli, whose talents in this area are so legendary that physicists have jokingly dubbed it the "Pauli effect." It is said that Pauli's mere presence in a laboratory would cause a glass apparatus to explode, or a sensitive measuring device to crack in half. In one particularly famous incident a physicist wrote Pauli to say that at least he couldn't blame Pauli for the recent and mysterious disintegration of a complicated piece of equipment since Pauli had not been present, only to find that Pauli had been passing by the laboratory in a train at the precise moment of the mishap! Jahn and Dunne think the famous "Gremlin effect," the tendency of carefully tested pieces of equipment to undergo inexplicable malfunctions at the most absurdly inopportune moments, often reported by pilots, aircrew, and military operators, may also be an example of unconscious PK activity.

If our minds can reach out and alter the movement of a cascade of

marbles or the operation of a machine, what strange alchemy might account for such an ability? Jahn and Dunne believe that since all known physical processes possess a wave/particle duality, it is not unreasonable to assume that consciousness does as well. When it is partielelike, consciousness would appear to be localized in our heads, but in its wavelike aspect, consciousness, like all wave phenomena, could also produce remote influence effects. They believe one of these remote influence effects is PK.

But Jahn and Dunne do not stop here. They believe that reality is itself the result of the interface between the waveu'ke aspects of consciousness and the wave patterns of matter. However, like Bohm, they do not believe that consciousness or the material world can be productively represented in isolation, or even that PK can be thought of as the transmission of some kind of force. "The message may be more subtle than that," says Jahn. "It may be that such concepts are simply unviable, that we cannot talk profitably about an abstract environment or an abstract consciousness. The only thing we can experience is the interpenetration of the two in some way."[7]

If PK cannot be thought of as the transmission of some kind of force, what terminology might better sum up the interaction of mind and matter? In thinking that is again similar to Bohm's, Jahn and Dunne propose that PK actually involves an exchange of information between consciousness and physical reality, an exchange that should be thought of less as a flow between the mental and the material, and more as a *resonance* between the two. The importance of resonance was even sensed and commented on by the volunteers in the PK experiments, in that the most frequently mentioned factor associated with a successful performance was the attainment of a feeling of "resonance" with the machine. One volunteer described the feeling as "a state of immersion in the process which leads to a loss of awareness of myself. I don't feel any direct control over the device, more like a marginal influence when I'm in resonance with the machine. It's like being in a canoe; when it goes where I want, I flow with it. When it doesn't I try to break the flow and give it a chance to get back m resonance with me."[8]

Jahn and Dunne's ideas are similar to Bohm's in several other key ways. Like Bohm, they believe that the concepts we use to describe reality—electron, wavelength, consciousness, time, frequency—are useful only as "information-organizing categories" and possess no independent status. They also believe that all theories, including their

own, are only metaphors. Although they do not identify themselves with the holographic model (and their theory does in fact differ from Bohm's thinking in several significant ways), they do recognize the overlap. "To the extent that we're talking about a rather basic reliance on wave mechanical behavior, there is some commonality between what we're postulating and the holographic idea," says Jahn. "It gives to consciousness the capacity to function in a wave mechanical sense and thereby to avail itself, one way or another, of all of space and time."[9]

Dunne agrees: "In some sense the holographic model could be perceived as addressing the mechanism whereby the consciousness interacts with that wave mechanical, aboriginal, sensible muchness, and somehow manages to convert it into usable information. In another sense, if you imagine that the individual consciousness has its own characteristic wave patterns, you could view it—metaphorically, of course—as the laser of a particular frequency that intersects with a specific pattern in the cosmic hologram."[10]

As might be expected, Jahn and Dunne's work has been greeted with considerable resistance by the scientific orthodox community, but it is gaining acceptance in some quarters. A good deal of PEAR's funding comes from the McDonnell Foundation, created by James S. McDonnell III, of the McDonnell Douglas Corporation, and the *New York Times Magazine* recently devoted an article to Jahn and Dunne's work. Jahn and Dunne themselves remain undaunted by the fact that they are devoting so much time and effort to exploring the parameters of a phenomenon considered nonexistent by most other scientists. As Jahn states, "My sense of the importance of this topic is much higher than anything else I've ever worked on."[11]

Psychokinesis on a Grander Scale

So far, PK effects produced in the lab have been limited to relatively small objects, but the evidence suggests that some individuals at least can use PK to bring about even greater changes in the physical world. Biologist Lyal! Watson, author of the bestselling book *Supernature* and a scientist who has studied paranormal events all over the world, encountered one such individual while visiting the Philippines. The man was one of the so-called Philippine psychic healers, but instead of

touching a patient, all he did was hold his hand about ten inches over the person's body, point at his or her skin, and an incision would appear instantaneously. Watson not only witnessed several displays of the man's psych ok inetic surgical skills, but once, when the man made a broader sweep with his finger than usual, Watson received an incision on the back of his own hand. He bears the scar to this day."

There is evidence that PK abilities can also be used to heal bones. Several examples of such healings have been reported by Dr. Rex Gardner, a physician at Sunderland District General Hospital in England. One interesting aspect of a 1983 article in the *British Medical Journal* is that Gardner, an avid investigator of miracles, presents contemporary miraculous healings side by side with examples of virtually identical healings collected by seventh-century English historian and theologian the Venerable Bede.

The present-day healing involved a group of Lutheran nuns living in Darmstadt, Germany. The nuns were building a chapel when one of the sisters broke through a freshly cemented floor and fell onto a wooden beam below. She was rushed to the hospital where X rays revealed that she had a compound pelvic fracture. Instead of relying on standard medical techniques, the nuns held an all-night prayer vigil. Despite the doctors' insistence that the sister should remain in traction for many weeks, the nuns took her home two days later and continued to pray and perform a laying on of hands. To their surprise, immediately following the laying on of hands, the sister stood up from her bed, free of the excruciating pain of the fracture and apparently healed. It took her only two weeks to achieve a full recovery, whereupon she returned to the hospital and presented herself to her astonished doctor.[1]"

Although Gardner does not try to account for this or any of the other healings he discusses in his article, PK seems a likely explanation. Given that the natural healing of a fracture is a lengthy process, and even the miraculous regeneration of Michelli's pelvis took several months, it is suggested that perhaps the unconscious PK abilities of the nuns performing the laying on of hands accomplished the task.

Gardner describes a similar healing that occurred in the seventh Century during the building of the church at Hexham, England, and involving St. Wilfrid, then the bishop of Hexham. During the construction of the church a mason named Bothelm fell from a great height, breaking both his arms and legs. As he lay dying, Wilfrid prayed over him and asked the other workmen to join him. They did, "the breath

of life returned" to Bothelm, and he healed rapidly. Since the healing apparently did not take place until St. Wilfred asked the other workmen to join him, one wonders if St. Wilfred was the catalyst, or again if it was the combined unconscious PK of the entire assemblage?

Dr. William Tufts Brigham, the curator of the Bishop Museum in Honolulu and a noted botanist who devoted much of his private life to investigating the paranormal, recorded an incident in which a broken bone was instantaneously healed by a native Hawaiian shaman, or *kahuna.* The incident was witnessed by a friend of Brigham's named J. A. K. Combs. Combs's grandmother-in-law was considered one of the most powerful women kahunas in the islands, and once, while attending a party at the woman's home, Combs observed her abilities firsthand.

On the occasion in question, one of the guests slipped and fell in the beach sand, breaking his leg so severely that the bone ends pressed visibly out against the skin. Recognizing the seriousness of the break, Combs recommended that the man be taken to a hospital immediately, but the elderly kahuna would hear none of it Kneeling beside the man, she straightened his leg and pushed on the area where the fractured bones pressed out against his skin. After praying and meditating for several minutes she stood up and announced that the healing was finished. The man rose wonderingly to his feet, took a step, and then another. He was completely healed and his leg showed no indication of the break in any way.[14]

Mass Psychokinesis in Eighteenth-Century France

Such incidents notwithstanding, one of the most astounding manifestations of psychokinesis, and one of the most remarkable displays of miraculous events ever recorded, took place in Paris in the first half of the eighteenth century. The events centered around a puritanical sect of Dutch-influenced Catholics known as the Jansenists, and were precipitated by the death of a saintly and revered Jansenist deacon named Francois de Paris. Although few people living today have even heard of the Jansenist miracles, they were one of the most talked about events in Europe for the better part of a century.

To understand fully the Jansenist miracles, it is necessary to know a little about the historical events that preceded Francois de Paris's

death. Jansenism was founded in the early seventeenth century, and from the start it was at odds with both the Roman Catholic Church and the French monarchy. Many of the beliefs diverged sharply with standard church doctrine but it was a popular movement and quickly gained followers among the French populace. Most damning of all, it was viewed by both the papacy and King Louis XV, a devout Catholic, as Protestantism only masquerading as Catholicism. As a result, both the church and the king were constantly maneuvering to undermine the movement's power. One obstacle to these maneuverings, and one of the factors that contributed to the movement's popularity, was that Jansenist leaders seemed especially skilled at performing miraculous healings. Nonetheless, the church and the monarchy persevered, causing fierce debates to rage throughout France. It was on May 1, 1727, at the height of this power struggle, that Francois de Paris died and was interred in the parish cemetery of Saint-Medard, Paris.

Because of the abbe's saintly reputation, worshipers began to gather at his tomb, and from the beginning a host of miraculous healings were reported. The aiiments thus cured included cancerous tumors, paralysis, deafness, arthritis, rheumatism, ulcerous sores, persistent fevers, prolonged hemorrhaging, and blindness. But this was not all. The mourners also started to experience strange involuntary spasms or convulsions and to undergo the most amazing contortions of their limbs. These seizures quickly proved contagious, spreading like a brush fire until the streets were packed with men, women, and children, all twisting and writhing as if caught up in a surreal enchantment.

It was while they were in this fitful and trancelike state that the "convulsionaires," as they have come to be called, displayed the most phenomenal of their talents. One was the ability to endure without harm an almost unimaginable variety of physical tortures. These in* eluded severe beatings, blows from both heavy and sharp objects, and strangulation—*all with no sign of injury, or even the slightest trace of wounds or bruises.*

What makes these miraculous events so unique is that they were witnessed by literally thousands of observers. The frenzied gatherings around Abbe Paris's tomb were by no means short-lived. The cemetery and the streets surrounding it were crowded day and night for years, and even two decades later miracles were still being reported (to give some idea of the enormity of the phenomena, in 1733 it was noted in the public records that over 3,000 volunteers were

needed simply to assist the convulsionaires and make sure, for example, that the female participants did not become immodestly exposed during their seizures). As a result, the supernormal abilities of the convulsionaires became an international cause celebre, and thousands flocked to see them, including individuals from all social strata and officials from every educational, religious, and governmental institution imaginable; numerous accounts, both official and unofficial, of the miracles witnessed are recorded in the documents of the time.

Moreover, many of the witnesses, such as the investigators from the Roman Catholic Church, had a vested interest in refuting the Jansenist miracles, but they still went away confirming them (the Roman Catholic Church later remedied this embarrassing state of affairs by conceding that the miracles existed but were the work of the devil, hence proving that the Jansenists were depraved).

One investigator, a member of the Paris Parliament named Louis-Basile Carre de Montgeron, witnessed enough miracles to fill four thick volumes on the subject, which he published in 1737 under the title *La Verite des Miracles.* In the work he provides numerous examples of the convulsionaries' apparent invulnerability to torture. In one instance a twenty-year-old convulsion aire named Jeanne Maulet leaned against a stone wall while a volunteer from the crowd, "a very strong man," delivered one hundred blows to her stomach with a thirty-pound hammer (the convulsionaires themselves asked to be tortured because they said it relieved the excruciating pain of the convulsions). To test the force of the blows, Montgeron himself then took the hammer and tried it on the stone wall against which the girl had leaned. He wrote, "At the twenty-fifth blow the stone upon which I struck, which had been shaken by the preceding efforts, suddenly became loose and fell on the other side of the wall, making an aperture more than half a foot in size."[10]

Montgeron describes another instance in which a convulsionaire bent back into an arc so that her lower back was supported by "the sharp point of a peg." She then asked that a fifty-pound stone attached to a rope be hoisted to "an extreme height" and allowed to fall with all its weight on her stomach. The stone was hoisted up and allowed to fall again and again, but the woman seemed completely unaffected by iL She effortlessly maintained her awkward position, suffered no pain or harm, and walked away from the ordeal without even so much as a mark on the flesh of her back. Montgeron noted that while the ordeal was in progress she kept crying out, "Strike harder, harder!"[16]

In fact, it appears that nothing could harm the convulsionaires. They could not be hurt by the blows of metal rods, chains, or timbers. The strongest men could not choke them. Some were crucified and afterward showed no trace of wounds.[17] Most mind-boggling of ail, they could not even be cut or punctured with knives, swords, or hatchets! Montgeron cites an incident in which the sharpened point of an iron drill was held against the stomach of a convulsionaire and then pounded so violently with a hammer that it seemed "as if it would penetrate through to the spine and rupture all the entrails." But it didn't, and the convulsionaire maintained an "expression of perfect rapture," crying, "Oh, that does me good! Courage, brother; strike twice as hard, if you can!"[18]

Invulnerability was not the only talent the Jansenists displayed during their seizures. Some became clairvoyant and were able to "discern hidden things." Others could read even when their eyes were closed and tightly bandaged, and instances of levitation were reported. One of the levitators, an abbe named Bescherand from Montpellier, was so "forcibly lifted into the air" during his convulsions that even when witnesses tried to hold him down they could not succeed in keeping him from rising up off of the ground.[19]

Although we have all but forgotten about the Jansenist miracles today, they were far from ignored by the intelligentsia of the time. The niece of the mathematician and philosopher Pascal succeeded in having a severe ulcer in her eye vanish within hours as the result of a Jansenist miracle. When King Louis XV tried unsuccessfully to stop the convulsionaires by closing the cemetery of Saint-Medard, Voltaire quipped, "God was forbidden, by order of the King, to work any miracles there." And in his *Philosophical Essays* the Scottish philosopher David Hume wrote, "There surely never was so great a number of miracles ascribed to one person as those which were lately said to have been wrought in France upon the tomb of Abbe Paris. Many of the miracles were immediately proved upon the spot, before judges of unquestioned credit and distinction, in a learned age, and on the most eminent theatre that is now in the world."

How are we to explain the miracles produced by the convulsionaires? Although Bohm is willing to consider the possibility of PK and other paranormal phenomena, he prefers not to speculate about specific events such as the supernormal abilities of the Jansenists. But once again, if we take the testimony of so many witnesses seriously, unless we are willing to concede that God favored the Jansenist Catho-

lies over the Roman, PK seems the likely explanation. That some kind of psychic functioning was involved is strongly suggested by the appearance of other psychic abilities, such as clairvoyance, during the seizures. In addition, we have already looked at a number of examples where intense faith and hysteria have triggered the deeper forces of the mind, and these too were present in ample portions. In fact, instead of being produced by one individual, the psyehokinetic effects may have been created by the combined fervor and belief of all those present, and this might account for the unusual vigor of the manifestations. This idea is not new. In the 1920s the great Harvard psychologist William McDougall also suggested that religious miracles might be the result of the collective psychic powers of large numbers of worshipers.

PK would explain many of the convulsionaire's seeming invulnerabilities. In the case of Jeanne Maulet it could be argued that she unconsciously used PK to block the effect of the hammer blows. If the convulsionaires were unconsciously using PK to take control of chains, timbers, and knives, and stop them in their tracks at the precise moment of impact, it would also explain why these objects left no marks or bruises. Similarly, when individuals tried to strangle the Jansenists, perhaps their hands were held in place by PK and although they thought they were squeezing flesh, they were really only flexing in the nothingness.

Reprogramming the Cosmic Motion Picture Projector

PK does not explain every aspect of the convulsionaires' invulnerability, however. There is the problem of inertia—the tendency of an object in motion to stay in motion—to consider. When a fifty-pound stone or a piece of timber comes crashing down, it carries with it a lot of energy, and when it is stopped in its tracks, the energy has to go somewhere. For example, if a person in a suit of armor is struck by a thirty-pound hammer, although the metal of the armor may deflect the blow, the person is still considerably shaken. In the case of Jeanne Maulet it appears that the energy somehow bypassed her body and was transferred to the wall behind her, for as Montgeron noted, the stone was "shaken by the efforts." But in the case of the woman who was arched and had the fifty-pound stone dropped on her abdomen, the

matter is less clear. One wonders why she wasn't driven into the ground like a croquet hoop, or why, when they were struck with timbers, the convulsionaires were not knocked off their feet? Where did the deflected energy go?

Again, the holographic view of reality provides a possible answer. As we have seen, Bohm believes that consciousness and matter are just different aspects of the same fundamental something, a something that has its origins in the implicate order. Some researchers believe this suggests that the consciousness may be able to do much more than make a few psyehokinetic changes in the material world. For example, Grof believes that if the implicate and explicate orders are an accurate description of reality, "it is conceivable that certain unusual states of consciousness could mediate direct experience of, and intervention in, the implicate order. It would thus be possible to modify phenomena in the phenomenal world by influencing their generative matrix."[20] Put another way, in addition to psychokinetically moving objects around, the mind may also be able to reach down and reprogram the cosmic motion picture projector that created those objects in the first place. Thus, not only could the conventionally recognized rules of nature, such as inertia, be completely bypassed, but the mind could alter and reshape the material world in ways far more dramatic than even psychokinesis implies.

That this or some other theory must be true is evidenced in another supernormal ability displayed by various individuals throughout history: invulnerability to fire. In his book *The Physical Phenomena of Mysticism,* Thurston gives numerous examples of saints who possessed this ability, one of the most famous being St. Francis of Paula. Not only could St. Francis of Paula hold burning embers in his hands without being harmed, but at his canonization hearings in 1519 eight eyewitnesses testified that they had seen him walk unharmed through the roaring flames of a furnace to repair one of the furnace's broken walls.

The account brings to mind the Old Testament story of Shadrach, Meshach, and Abednego. After capturing Jerusalem, King Nebuchadnezzar ordered everyone to worship a statue of himself. Shadrach, Meshach, and Abednego refused, so Nebuchadnezzar ordered them thrown into a furnace so "exceeding hot" that the flames even burned up the men who threw them in. However, because of their faith, they survived the fire unscathed, and came out with their hair unsinged, their clothing unharmed, and not even the smell of fire upon them. It

seems that challenges to faith, such as the one King Louis XV tried to impose on the Jansenists, have engendered miracles in more than one instance.

Although the kahunas of Hawaii do not walk through roaring furnaces, there are reports that they can stroll across hot lava without being harmed. Brigham told of meeting three kahunas who promised to perform the feat for him, and of following them on a lengthy trek to a lava flow near the erupting Kilauea. They chose a 150-foot-wide lava flow that had cooled enough to support their weight, but was so hot that patches of incandescence still coursed through its surface. As Brigham watched, the kahunas took off their sandals and started to recite the lengthy prayers necessary to protect them as they strolled out onto the barely hardened molten rock.

As it turned out, the kahunas had told Brigham earlier that they could confer their fire immunity on htm if he wanted to join them, and he had bravely agreed. But as he faced the baking heat of the lava he had second and even third thoughts. "The upshot of the matter was that I sat tight and refused to take off my boots," Brigham wrote in his account of the incident. After they finished invoking the gods, the oldest kahuna scampered out onto the lava and crossed the 150 feet without harm. Impressed, but still adamant about not going, Brigham stood up to watch the next kahuna, only to be given a shove that forced him to break into a run to keep from falling face first onto the incandescent rock.

And run Brigham did. When he reached higher ground on the other side he discovered that one of his boots had burned off and his socks were on fire. But, miraculously, his feet were completely unharmed. The kahunas had also suffered no harm and were rolling in laughter at Brigham's shock. "I laughed too," wrote Brigham. "I was never so relieved in my life as I was to find that I was safe. There is little more that I can tell of this experience. I had a sensation of intense heat on my face and body, but almost no sensation in my feet."[111]

The convulsionaires also occasionally displayed complete immunity to fire. The two most famous of these "human salamanders"—in the middle ages the term *salamander* referred to a mythological lizard believed to live in fire—were Marie Sonnet and Gabrielle Moler. On one occasion, and tn the presence of numerous witnesses, including Mont-geron, Sonnet stretched herself on two chairs over a blazing fire and remained there for half an hour. Neither she nor her clothing showed

any ill effects. In another instance she sat with her feet in a brazier full of burning coals. As with Brigham, her shoes and stockings burned off, but her feet were unharmed.[22]

Gabrielle Moler's exploits were even more dumbfounding. In addition to being impervious to the thrusts of swords and blows delivered by a shovel, she could stick her head into a roaring hearth fire and hold it there without suffering any injury. Eyewitnesses report that afterward her clothing was so hot it could barely be touched, yet her hair, eyelashes, and eyebrows were never so much as singed.[23] No doubt she was great fun at parties.

Actually the Jansenists were not the first convulsionary movement in France. In the late 1600s, when King Louis XIV tried to purge the country of the unabashedly Protestant Huguenots, a group of Huguenot resistors in the valley of the Cevennes and known as the Cami-sards displayed similar abilities. In an official report sent to Rome, one of the persecutors, a prior named Abbe du Chayla, complained that no matter what he did, he could not succeed in harming the Camisards. When he ordered them shot, the musket balls would be found flattened between their clothing and their skin. When he closed their hands upon burning coals, they were not harmed, and when he wrapped them head to toe in cotton soaked with oil and set them on fire, they did not burn.[24]

As if this weren't enough, Claris, the Camisard leader, ordered that a pyre be built and then climbed to the top of it to deliver an ecstatic speech. In the presence of six hundred witnesses he ordered the pyre be set on fire and continued to rant as the flames rose above his head. After the pyre was completely consumed, Claris remained, unharmed and with no mark of the fire on his hair or clothing. The head of the French troops sent to subdue the Camisards, a colonel named Jean Cavalier, was later exiled to England where he wrote a book on the event in 1707 entitled *A Cry from the Desert*[25] As for Abbe du Chayla, he was eventually murdered by the Camisards during a retaliatory raid. Unlike some of them, he possessed no special invulnerability.-[6]

Literally hundreds of credible accounts of fire immunity exist It is reported that when Bernadette of Lourdes was in ecstasy she was also impervious to fire. According to witnesses, on one occasion her hand dropped so close to a burning candle while she was in trance that the flames licked around her fingers. One of the individuals present was Dr. Dozous, the municipal physician of Lourdes. Being of quick mind,

Dozous timed the event and noted that it was a full ten minutes before she came out of trance and removed her hand. He iater wrote, "I saw it with my own eyes. But I swear, if anyone had tried to make me believe such a story I would have laughed him to scorn.'*[27]

On September 7,1871, the *New York Herald* reported that Nathan Coker, an elderly Negro blacksmith living in Easton, Maryland, could handle red-hot metal without being harmed. In the presence of a committee that included several doctors, he heated an iron shovel until it was incandescent and then held it against the soles of his feet until it was cool. He also licked the edge of the red-hot shovel and poured melted lead shot in his mouth, allowing it to run over his teeth and gums until it solidified. After each of these feats the doctors examined him and found no trace of injury.[3]"

While on a hunting trip in 1927 in the Tennessee mountains, K. R. Wissen, a New York physician, encountered a twelve-year-old boy who was similarly impervious. Wissen watched the boy handle red-hot irons out of a fireplace with impunity. The boy told Wissen he had discovered his ability by accident when he picked up a red-hot horseshoe in his uncle's blacksmith shop.[29] The pit of flaming embers the Grosvenors watched Mohotty walk through was twenty-feet long and measured 1328 degrees Fahrenheit on the *National Geographic* team's thermometers. In the May 1959 issue of the *Atlantic Monthly,* Dr. Leonard Feinberg of the University of Illinois reports witnessing another Ceylonese fire-walking ritual during which the natives carried red-hot iron pots on their heads without being harmed. In an article in *Psychiatric Quarterly,* psychiatrist Berthold Schwarz reports watching Appalachian Pentecostals hold their hands in an acetylene flame without being harmed,[30] and so on, and so on.

The Laws of Physics as Habits and Realities Both Potential and Real

Just as it is hard to imagine where the deflected energy goes in some of the examples of PK we have looked at, it is equally difficult to understand where the energy of a red-hot iron pot goes while the pot is resting flat against the hair and flesh of a Ceylonese native's head.

But if consciousness can mediate directly in the implicate order, it becomes a more tractable problem. Again, rather than being due to some undiscovered energy or law of physics (such as some kind of insulating force field) that operates *within* the framework of reality, it would result from activity on an even more fundamental level and involve the processes that create both the physical universe and the laws of physics in the first place.

Looked at another way, the ability of consciousness to shift from one entire reality to another suggests that the usually inviolate rule *ths.tfire burns human fiesh* may only be one program in the cosmic computer, but a program that has been repeated so often it has become one of nature's habits. As has been mentioned, according to the holographic idea, matter is also a kind of habit and is constantly born anew out of the implicate, just as the shape of a fountain is created anew out of the constant flow of water that gives it form. Peat humorously refers to the repetitious nature of this process as one of the universe's neuroses. "When you have a neurosis you tend to repeat the same pattern in your life, or do the same action, as if there's a memory built up and the thing is stuck with that," he says. "I tend to think things like chairs and tables are like that also. They're a sort of material neurosis, a repetition. But there is something subtler going on, a constant enfolding and unfolding. In this sense chairs and tables are just habits in this flux, but the Mux is the reality, even if we tend only to see the habit."[31]

Indeed, given that the universe and the laws of physics that govern it are also products of this flux, then they, too, must be viewed as habits. Clearly they are habits that are deeply ingrained in the holo-movement, but supernormal talents such as immunity to fire indicate that, despite their seeming constancy, at least some of the rules that govern reality can be suspended. This means the laws of physics are not set in stone, but are more like Shainberg's vortices, whirlpools of such vast inertial power that they are as fixed in the holomovement as our own habits and deeply held convictions are fixed in our thoughts.

Grof s proposal that altered states of consciousness may be required in order to make such changes in the implicate is aiso attested to by the frequency with which fire immunity is associated with heightened faith and religious zeal. The pattern that began to take shape in the last chapter continues, and its message becomes increasingly

clear—the deeper and more emotionally charged our beliefs, the greater the changes; we can make in both our bodies and reality itself.

At this point we might ask, if consciousness can make such extraordinary alterations under special circumstances, what role does it play in the creation of our day-to-day reality? Opinions are extremely varied. In private conversation Bohm admits to believing that the universe is all "thought" and reality exists oniy in what we think,[32] but again he prefers not to speculate about miraculous occurrences. Pribram is similarly reticent to comment on specific events but does believe a number of different potential realities exist and consciousness has a certain amount of latitude in choosing which one manifests. "I don't believe anything goes," he says, "but there are a lot of worlds out there that we don't understand."[33]

After years of firsthand experiences with the miraculous, Watson is bolder. "I have no doubt that reality is in a very large part a construct of the imagination. I am not speaking as a particle physicist or even as someone who is totally aware of what's going on in the frontier of that discipline, but I think we have the capacity to change the world around us in quite fundamental ways" (Watson, who was once enthusiastic about the holographic idea, is no longer convinced that *any* current theory in physics can adequately explain the supernormal abilities of the mind).[3]"

Gordon Globus, a professor of psychiatry and philosophy at the University of California at Irvine, has a different but similar view. Globus thinks the holographic theory is correct in its assertion that the mind constructs concrete reality out of the raw material of the implicate. However, he has also been greatly influenced by anthropologist Carlos Castaneda's now famous otherworldly experiences with the Yaqui Indian shaman, Don Juan. In stark contrast to Pribram, he believes that the seemingly inexhaustible array of "separate realities" Castaneda experienced under Don Juan's tutelage—and indeed even the equally vast array of realities we experience during ordinary dreaming—indicate that there are an infinite number of potential realities enfolded in the implicate. Moreover, because the holographic mechanisms the brain uses to construct everyday reality are the same ones it uses to construct our dreams and the realities we experience during Castanedaesque altered states of consciousness, he believes all three types of reality are fundamentally the same.[3]*

Does Consciousness Create Subatomic Particles or Not Create Subatomic Particles, That is the Question

This difference of opinion indicates once again that the holographic theory is still very much an idea in the making, not unlike a newly formed Pacific island whose volcanic activity keeps it from having clearly defined shores. Although some might use this lack of consensus to criticize it, it should be remembered that Darwin's theory of evolution, certainly one of the most potent and successful ideas science has ever produced, is also still very much in a state of flux, and evolutionary theorists continue to debate its scope, interpretation, regulatory mechanisms, and ramifications.

The difference of opinion also reveals just how complex a puzzle miracles are. Jahn and Dunne offer *yet* another opinion on the role consciousness plays in the creation of day-to-day reality, and although it differs from one of Bohm's basic premises, because of the possible insight it offers into the process by which miracles are effected, it deserves our attention.

Unlike Bohm, Jahn and Dunne believe subatomic particles do *not* possess a distinct reality until consciousness enters the picture. "I think we have long since passed the place in high energy physics where we're examining the structure of a passive universe," Jahn states. "I think we're into the domain where the interplay of consciousness in the environment is taking place on such a primary scale that we are indeed creating reality by any reasonable definition of the term."™

As has been mentioned, this is the view held by most physicists. However, Jahn and Dunne's position differs from the mainstream in an important way. Most physicists would reject the idea that the interplay between consciousness and the subatomic world could in any way be used to explain PK, let alone miracles. In fact, the majority of physicists not only ignore any implications this interplay might have but actually behave as if it doesn't exist. "Most physicists develop a somewhat schizophrenic view," says quantum theorist Fritz Eohrlich of Syracuse University. "On the one hand they accept the standard interpretation of quantum theory. On the other they insist on the reality of quantum systems even when these are not observed."[37]

This bizarre I'm-not-going-to-think-about-it-even-when-I-know-it's-

true attitude keeps many physicists from considering even the philosophical implications of quantum physics' most incredible findings. As N. David Mermin, a physicist at Cornell University, points out, physicists fall into three categories: a small minority is troubled by the philosophical implications; a second group has elaborate reasons why they are not troubled, but their explanations tend "to miss the point entirely"; and a third group has no elaborate explanations but also refuses to say why they aren't troubled. "Their position is unassailable," says Mermin.[38]

Jahn and Dunne are not so timid. They believe that instead of discovering particles, physicists may actually be *creating* them. As evidence, they cite a recently discovered subatomic particle called an *anomalon,* whose properties vary from laboratory to laboratory. Imagine owning a car that had a different color and different features depending on who drove it! This is very curious and seems to suggest that an anomalon's reality depends on who finds/creates it.[39]

Similar evidence may also be found in another subatomic particle. In the 1930s Pauli proposed the existence of a massless particle called a *neutrino* to solve an outstanding problem concerning radioactivity. For years the neutrino was only an idea, but then in 1957 physicists discovered evidence of its existence. In more recent years, however, physicists have realized that if the neutrino possessed some mass, it would solve several even thornier problems than the one facing Pauli, and lo and behold in 1980 evidence started to come in that the neutrino had a small but measurable mass! This is not all. As it turned out, only laboratories in the Soviet Union discovered neutrinos with mass. Laboratories in the United States did not. This remained true for the better part of the 1980s, and although other laboratories have now duplicated the Soviet findings, the situation is still unresolved,[40]

Is it possible that the different properties displayed by neutrinos are due at least in part to the changing expectations and different cultural biases of the physicists who searched for them? If so, such a state of affairs raises an interesting question. If physicists do not discover the subatomic world but create it, why do some particles, such as electrons, appear to have a stable reality no matter who observes them? In other words, why does a physics student with no knowledge of an electron still discover the same characteristics that a seasoned physicist discovers?

One possible answer is that our perceptions of the world may not be based solely on the information we receive through our five senses.

As fantastic as this may sound, a very good case can be made for such a notion. Before explaining, I would like to relate an occurrence I witnessed in the middle 1970s. My father had hired a professional hypnotist to entertain a group of friends at his house and had invited me to attend the event. After quickly determining the hypnotic susceptibility of the various individuals present, the hypnotist chose a friend of my father's named Tom as his subject. This was the first time Tom had ever met the hypnotist.

Tom proved to be a very good subject, and within seconds the hypnotist had him in a deep trance. He then proceeded with the usual tricks performed by stage hypnotists. He convinced Tom there was a giraffe in the room and had Tom gaping in wonder. He told Tom that a potato was really an apple and had Tom eat it with gusto. But the highlight of the evening was when he told Tom that when he came out of trance, his teenage daughter, Laura, would be completely invisible to him. Then, after having Laura stand directly in front of the chair in which Tom was sitting, the hypnotist awakened him and asked him if he could see her.

Tom looked around the room and his gaze appeared to pass right through his giggling daughter. "No," he replied. The hypnotist asked Tom if he was certain, and again, despite Laura's rising giggles, he answered no. Then the hypnotist went behind Laura so he was hidden from Tom's view and pulled an object out of his pocket. He kept the object carefully concealed so that no one in the room could see it, and pressed it against the small of Laura's back. He asked Tom to identify the object. Tom leaned forward as if staring directly through Laura's stomach and said that it was a watch. The hypnotist nodded and asked if Tom could read the watch's inscription. Tom squinted as if struggling to make out the writing and recited both the name of the watch's owner (which happened to be a person unknown to any of us in the room) and the message. The hypnotist then revealed that the object was indeed a watch and passed it around the room so that everyone could see that Tom had read its inscription correctly.

When I talked to Tom afterward, he said that his daughter had been absolutely invisible to him. All he had seen was the hypnotist standing and holding a watch cupped in the palm of his hand. Had the hypnotist let him leave without telling him what was going on, he never would have known he wasn't perceiving normal consensus reality.

Obviously Tom's perception of the watch was not based on information he was receiving through his five senses. Where was he getting

the information from? One explanation is that he was obtaining it telepathically from someone else's mind, in this case, the hypnotist's. The ability of hypnotized individuals to "tap" into the senses of other people has been reported by other investigators. The British physicist Sir William Barrett found evidence of the phenomenon in a series of experiments with a young girl. After hypnotizing the girl he told her that she would taste everything he tasted. "Standing behind the girl, whose eyes I had securely bandaged, I took up some salt and put it in my mouth; instantly she sputtered and exclaimed, 'What for are you putting salt in my mouth?' Then I tried sugar; she said 'That's better'; asked what it was like, she said 'Sweet' Then mustard, pepper, ginger, et cetera were tried; each was named and apparently tasted by the girl when I put them in my own mouth,"[41]

In his book *Experiments in Distant Influence* the Soviet physiologist Leonid Vasiliev cites a German study conducted in the 1950s that produced similar findings. In that study, the hypnotized subject not only tasted what the hypnotist tasted, but blinked when a light was flashed in the hypnotist's eyes, sneezed when the hypnotist took a whiff of ammonia, heard the ticking of a watch held to the hypnotist's ear, and experienced pain when the hypnotist pricked himself with a needle—all done in a manner that safeguarded against her obtaining the information through normal sensory cues."[2]

Our ability to tap into the senses of others is not limited to hypnotic states. In a now famous series of experiments physicists Harold Put-hoff and Russell Targ of the Stanford Research Institute in California found that just about everyone they tested had a capacity they call "remote viewing," the ability to describe accurately what a distant test subject is seeing. They found that individual after individual could remote-view simply by relaxing and describing whatever images came into their minds.[43] Puthoff and Targ's findings have been duplicated by dozens of laboratories around the world, indicating that remote viewing is probably a widespread latent ability in all of us.

The Princeton Anomalies Research lab has also corroborated Puthoff and Targ's findings. In one study Jahn himself served as the receiver and tried to perceive what a colleague was observing in Paris, a city Jahn has never visited. In addition to seeing a bustling street, an image of a knight in armor came into Jahn's mind. It later turned out that the sender was standing in front of a government building ornamented with statuary of historical military figures, one of whom was a knight in armor.[44]

So it appears that we are deeply interconnected with each other in yet another way, a situation that is not so strange in a holographic universe. Moreover, these interconnections manifest even when we are not consciously aware of them. Studies have shown that when a person in one room is given an electric shock, it will register in the polygraph readings of a person in another room."[lf]> A light flashed in a test subject's eyes will register in the EEG readings of a test subject isolated in another room,[46] and even the blood volume of a test subject's finger changes—as measured by a plethysinograph, a sensitive indicator of autonomic nervous system functioning—when a "sender" in another room encounters the name of someone they know while reading a list composed mainly of names unknown to them.[4T]

Given both our deep interconnectedness and our ability to construct entirely convincing realities out of information received via this inter-connectedness, such as Tom did, what would happen if two or more hypnotized individuals tried to construct the same imaginary reality? Intrigumgly, this question has been answered in an experiment conducted by Charles Tart, a professor of psychology at the Davis campus of the University of California, Tart found two graduate students, Anne and Bill, who could go into deep trance and were also skilled hypnotists in their own right. He had Anne hypnotize Bill and after he was hypnotized, he had Bill hypnotize her in return. Tart's reasoning was that the already powerful rapport that exists between hypnotist and subject would be strengthened by using this unusual procedure.

He was right. When they opened their eyes in this mutually hypnotized state everything looked gray. However, the grayness quickly gave way to vivid colors and glowing lights, and in a few moments they found themselves on a beach of unearthly beauty. The sand sparkled like diamonds, the sea was filled with enormous frothing bubbles and glistened like champagne, and the shoreline was dotted with translucent crystalline rocks pulsing with internal light. Although Tart could not see what Anne and Bill were seeing, from the way they were talking he quickly realized *they were experiencing the same hallucinated reality.*

Of course, this was immediately obvious to Anne and Bill and they set about to explore their newfound world, swimming in the ocean and studying the glowing crystalline rocks. Unfortunately for Tart they also stopped talking, or at least they stopped talking from Tart's perspective. When he questioned them about their silence they told him that in their shared dreamworld they *were* talking, a phenomenon

Tart feels involved some kind of paranormal communication between the two.

In session after session Anne and Bill continued to construct various realities, and all were as real, available to the five senses, and dimen-sionalty realized, as anything they experienced in their normal waking state. In fact, Tart resolved that the worlds Anne and Bill visited we're actually *more* real than the pale, lunar version of reality with which most of us must be content. As he states, after "they had been talking about their experiences to each other for some time, and found they had been discussing details of the experiences they had shared for which there were no verbal stimuli on the tapes, they felt they must have actually been 'in' the nonworldly locales they had experienced."[48]

Anne and Bill's ocean world is the perfect example of a holographic reality—a three-dimensional construct created out of interconnected-ness, sustained by the flow of consciousness, and ultimately as plastic as the thought processes that engendered it. This plasticity was evident in several of its features. Although it was three-dimensional, its space was more flexible than the space of everyday reality and sometimes took on an elasticity Anne and Bill had no words to describe. Even stranger, although they were clearly highly skilled at sculpting a shared world outside themselves, they frequently forgot to sculpt their own bodies, and existed more often than not as floating faces or heads. As Anne reports, on one occasion when Bill told her to give him her hand, "I had to kind of conjure up a hand."'[9]

How did this experiment in mutual hypnosis end? Sadly, the idea that these spectacular visions were somehow real, perhaps even more real than everyday reality, so frightened both Anne and Bill that they became increasingly nervous about what they were doing. They eventually stopped their explorations, and one of them, Bill, even gave up hypnosis entirely.

The extrasensory interconnectedness that allowed Anne and Bill to construct their shared reality might almost be viewed as a kind of field effect between them, a "reality-field" if you will. One wonders what would have happened if the hypnotist at my father's house had put all of us into a trance? In light of the evidence above, there is every reason to believe that if our rapport were deep enough, Laura would have become invisible to us all. We would have collectively constructed a reality-field of a watch, read its inscription, and been completely convinced that what we were perceiving was real.

If consciousness plays a role in the creation of subatomic particles,

is it possible that our observations of the subatomic world are also reality-fie Ids of a kind? If Jahn can perceive a suit of armor through the senses of a friend in Paris, is it any more farfetched to believe that physicists all around the world are unconsciously interconnecting with one another and using a form of mutual hypnosis similar to that used by Tart's subjects to create the consensus characteristies they observe in an electron? This possibility may be supported by another unusual feature of hypnosis. Unlike other altered states of consciousness, hypnosis is not associated with any unusual EEG patterns. Physiologically speaking, the mental state hypnosis most closely resembles is our normal waking consciousness. Does this mean that normal waking consciousness is itself a kind of hypnosis, and we are all constantly tapping into reality-fields?

Nobe list Josephs on has suggested that something like this may be going on. Like Globus, he takes Castaneda's work seriously and has attempted to relate it to quantum physics. He proposes that objective reality is produced out of the collective memories of the human race while anomalous events, such as those experienced by Castaneda, are the manifestation of the individual will.[50]

Human consciousness may not be the only thing that participates in the creation of reality-fields. Remote viewing experiments have shown that people can accurately describe distant locations even when there are no human observers present at the locations.[r,!] Similarly, subjects can identify the contents of a sealed box randomly selected from a group of sealed boxes and whose contents are therefore completely unknown.[52] This means that we can do more than just tap into the senses of other people. We can also tap into reality itself to gain information. As bizarre as this sounds, it is not so strange when one remembers that in a holographic universe, consciousness pervades all matter, and "meaning" has an active presence in both the mental and physical worlds.

Bohm believes the ubiquitousness of meaning offers a possible explanation for both telepathy and remote viewing. He thinks both may actually be just different forms of psychokinesis. Just as PK is a resonance of meaning conveyed from a mind to an object, telepathy can be viewed as a resonance of meaning conveyed from a mind to a mind, says Bohm. In like manner, remote viewing can be looked at as a resonance of meaning conveyed from an object to a mind. "When harmony or resonance of 'meanings' is established, the action works both ways, so that the 'meanings' of the distant system could act in

the viewer to produce a kind of inverse psychokinesis that would, in effect, transmit an image of that system to him," he states.^'

Jahn and Dunne have a similar view. Although they believe reality is established only in the interaction of a consciousness with its environment, they are very liberal in how they define consciousness. As they see it, anything capable of generating, receiving, or utilizing information can qualify. Thus, animals, viruses, DNA, machines {artificially intelligent and otherwise), and so-called nonliving objects may all have the prerequisite properties to take part in the creation of reality.[1"1]

If such assertions are true, and we can obtain information not only from the minds of other human beings but from the living hologram of reality itself, psychometry—the ability to obtain information about an object's history simply by touching it—would also be explained. Rather than being inanimate, such an object would be suffused with its own kind of consciousness. Instead of being a "thing" that exists separately from the universe, it would be part of the mterconnected-ness of all things—connected to the thoughts of every person who ever came in contact with it, connected to the consciousness that pervades every animal and object that was ever associated with its existence, connected via the implicate to its own past, and connected to the mind of the psychometrist holding it.

You Can Get Something for Nothing

Do physicists play a role in the creation of subatomic particles? At present the puzzle remains unresolved, but our ability to interconnect with one another and conjure up realities that are as real as our normal waking reality is not the only clue that this may be the case. Indeed, the evidence of the miraculous indicates that we have scarcely even begun to fathom our talents in this area. Consider the following miraculous healing reported by Gardner. In 1982 an English physician named Ruth Coggin, working in Pakistan, was visited by a thirty-five-year-old Pakistani woman named Kamro. Kamro was eight months pregnant and for the better part of her pregnancy had suffered from bleeding and intermittent abdominal pain. Coggin recommended that she go into the hospital immediately, but Kamro refused.

Nonetheless, two days later her bleeding became so severe that she was admitted on an emergency basis.

Coggin's examination revealed that Kamro's blood loss had been "very heavy," and her feet and abdomen were pathologically swollen. The next day Kamro had "another heavy bleed," forcing Coggin to perform a cesarean section. As soon as Coggin opened the uterus even more copious amounts of dark blood flooded out and continued to flow so heavily it became clear that Kamro had virtually no clotting ability. By the time Coggin delivered Kamro's healthy baby daughter, "deep pools of unclotted blood" filled her bed and continued to flow from her incision. Coggin managed to obtain two pints of blood to transfuse the gravely anemic woman, but it was not nearly enough to replace the staggering loss. Having no other options, Coggin resorted to prayer.

She writes, "We prayed with the patient after explaining to her about Jesus in whose name we had prayed for her before the operation, and who was a great healer, I also told her that we were not going to worry. I had seen Jesus heal this condition before and was sure He was going to heal her."[nr]'

Then they waited.

For the next several hours Kamro continued to bleed, but instead of getting worse, her general condition stabilized. That evening Coggin prayed with Kamro again, and although her "brisk bleeding" continued unabated, she seemed unaffected by the loss. Forty-eight hours after the operation her blood finally began to clot and her recovery started in full. Ten days later she went home with her baby.

Although Coggin had no way of measuring Kamro's actual blood loss, she had no doubts that the young mother had lost more than her total blood volume during the surgery and the profuse bleeding that ensued. After Gardner examined the documentation of the case, he agreed. The trouble with this conclusion is that human beings cannot produce new blood fast enough to cover such catastrophic losses; if they could, many fewer people would bleed to death. This leaves one with the unsettling conclusion that Kamro's new blood must have materialized out of thin air.

The ability to create an infinitesimal particle or two pales in comparison to the materialization of the ten to twelve pints of blood necessary to replenish the average human body. And blood is not the only thing we can create out of thin air. In June of 1974, while traveling in Timor Timur, a small island in easternmost Indonesia, Watson encountered

an equally confounding example of materialization. Although his original intention had been to visit a famous *matan do'ok,* a type of Indonesian wonder-worker who was said to be able to make it rain on demand, he was diverted by accounts of an unusually active *buan,* an evil spirit, wreaking havoc in a house in a nearby village.

The family living in the house consisted of a married couple, their two small boys, and the husband's unmarried younger half-sister. The couple and their children were typically Indonesian in appearance, with dark complexions and curly hair, but the half-sister, whose name was Alin, was physically very different and had a much lighter complexion and features that were almost Chinese, which accounted for her inability to obtain a husband. She was also treated with indifference by the family, and it was immediately plain to Watson that she was the source of the psychic disturbance.

That evening during dinner in the family's grass-roofed home, Watson witnessed several startling phenomena. First, without warning, the couple's eight-year-old boy screamed and dropped his cup on the table as the back of his hand began to bleed inexplicably. Watson, who was sitting next to the boy, examined his hand and saw that there was a semicircle of fresh punctures on it, like a human bite, but with a diameter larger than the boy's. Alin, always the odd person out, was busy at the fire opposite the boy when this occurred.

As Watson was examining the wounds, the lamp flame turned blue and abruptly flared up, and in the suddenly brighter light a shower of salt began to pour down over the food until it was completely covered and inedible. "It wasn't a sudden deluge, but a slow and deliberate action which lasted long enough for me to look up and see that it seemed to begin in midair, just about eye level, perhaps four feet over the table," says Watson.

Watson immediately leapt up from the table, but the show wasn't over. Suddenly a series of loud rapping sounds issued from the table, and it began to wobble. The family also jumped up and all watched as the table bucked "like the lid on a box containing some wild animal," and finally flipped over on its side. Watson first reacted by running out of the house with the rest of the family, but when he recovered his senses he returned and searched the room for evidence of any trickery that might account for the occurrence. He found none.[M]

The events that took place in the little Indonesian hut are classic examples of a poltergeist haunting, a type of haunting typified by mysterious sounds and psychokinetic activity rather than the appearances of ghosts or apparitions. Because poltergeists tend to center more around people, in this case Alin, rather than places, many para-psychologists believe they are actually manifestations of the unconscious psychokinetic ability of the person around whom they are most active. Even materialization has a long and illustrious history in the annals of poltergeist research. For instance, in his classic work on the subject, *Can We Explain the Poltergeist,* A. R. G. Owen, a fellow and lecturer in Mathematics at Trinity College, Cambridge, gives numerous examples of objects materializing out of thin air in poltergeist cases dating from A.D. 530 to modern times.[ST] Small stones and not salt, however, are the objects that materialize most often.

In the Introduction I mentioned that I had experienced firsthand many of the paranormal phenomena that would be discussed in this book and would relate a few of my own experiences. It is thus time to come clean and confess that I know how Watson must have felt after witnessing the sudden onslaught of psychokinetic activity in the little Indonesian hut because when I was a child, the house in which my family had recently moved (a new house that my parents themselves had built) became the site of an active poltergeist haunting. Since our poltergeist left my family's home and followed me when I went away to college, and since its activity very definitely seemed connected to my moods—its antics becoming more malicious when I was angry or my spirits were low, and more impish and whimsical when my mood was brighter—I have always accepted the idea that poltergeists are manifestations of the unconscious psychokinetic ability of the person around whom they are most active.

This connection to my emotions displayed itself frequently. If I was in a good mood, I might wake up to find all of my socks draped over the house plants. If I was in a darker frame of mind, the poltergeist might manifest by hurling a small object across the room or occasionally even by breaking something. Over the years both I and various family members and friends witnessed a wide range of psychokinetic activity. My mother tells me that even when I was a toddler pots and pans had already begun to jump inexplicably from the middle of the kitchen table to the floor. I have written about some of these experiences in my book *Beyond the Quantum.*

I do not make these disclosures lightly. I am aware of how alien such occurrences are to most people's experience and fully understand the skepticism with which they will be greeted in some quarters. Nonetheless, I am compelled to talk about them because I think it is vitally

important that we try to understand such phenomena and not just sweep them under the carpet.

Still it is with some trepidation that I admit that my own poltergeist also occasionally materialized objects. The materializations started when I was six years old, and inexplicable showers of gravel rained down on our roof at night. Later it took to pelting me *inside* my home with small polished stones and pieces of broken glass with edges worn like the shards of drift glass one finds on the beach. On rarer occasions it materialized other objects including coins, a necklace, and several odder trifles. Unfortunately, I usually did not see the actual materializations, but only witnessed their aftermath, such as when a pile of spaghetti noodles (sans sauce) fell on my chest one day while I was taking a nap in my New York apartment. Given that I was alone in a room with no open windows or doors, there was no one else in my apartment, and there was no sign that anyone had either cooked spaghetti or broken in to throw spaghetti at me, I can only assume that, for reasons unknown, the handful of cold spaghetti noodles that dropped out of midair and onto my chest materialized out of nowhere.

On a few occasions, however, I did see objects actually materialize. For example, in 1976 I was working in my study when I happened to look up and see a small brown object appear suddenly in midair just a few inches below the ceiling. As soon as it popped into existence it zoomed down at a sharp angle and landed at my feet. When I picked it up I saw that it was a piece of brown drift glass that originally might have been used in making beer bottles. It was not quite as spectacular as a shower of salt lasting several seconds, but it taught me that such things were possible.

Perhaps the most famous modern-day materializations are those produced by Sathya Sai Baba, a sixty-four-year-old Indian holy man living in a distant corner of the state of Andhra Pradesh in southern India. According to numerous eyewitnesses, Sai Baba is able to produce much more than salt and a few stones. He plucks lockets, rings, and jewelry out of the air and passes them out as gifts. He also materializes an endless supply of Indian delicacies and sweets, and out of his hands pour volumes of *mbuti,* or sacred ash. These events have been witnessed by literally thousands of individuals, including both scientists and magicians, and no one has ever detected any hint of trickery. One witness is psychologist Erlendur Haraldsson of the University of Iceland.

Haraldsson has spent over ten years studying Sai Baba and has

published his findings in a recent book entitled *Modern Miracles: An Investigative Report on Psychic Phenomena Associated with Sathya Sai Baba.* Although Haraldsson admits that he cannot prove conclusively that Sai Baba's productions are not the result of deception and sleight of hand, he offers a large amount of evidence that strongly suggests something supernormal is taking place.

For starters, Sai Baba can materialize specific objects on request. Once when Haraldsson was having a conversation with him about spiritual and ethical issues, Sai Baba said that daiiy life and spiritual life should "grow together like a *double rudraksha."* When Haraldsson asked what a double rudraksha was, neither Sai Baba nor the interpreter knew the English equivalent of the term. Sai Baba tried to continue with the diseussion, but Haraldsson remained insistent. "Then suddenly, with a sign of impatience, Sai Baba closed his list and waved his hand for a second or two. As he opened it, he turned to me and said: 'This is it.' In his palm was an acorn-like object. This was two rudrakshas grown together like a twin orange or a twin apple," says Haraldsson.

When Haraldsson indicated that he wanted to keep the double-seed as a memento, Sai Baba agreed, but first asked to see it again. "He enclosed the rudraksha in both his hands, blew on it, and opened his hands toward me. *The* double rudraksha was *now* covered, *on* the top and bottom, by two golden shields held together by a short golden chain. On the top was a golden cross with a small ruby affixed to it, and a tiny opening so that it could hang on a chain around the neck."[58] Haraldsson later discovered that double rudrakshas were extremely rare botanical anomalies. Several Indian botanists he consulted said they had never even seen one, and when he finally found a small, malformed specimen in a shop in Madras, the shopkeeper wanted the Indian equivalent of almost three hundred dollars for it. A London goldsmith confirmed that the gold in the ornamentation had a purity of at least twenty-two carats.

Such gifts are not rare. Sai Baba frequently hands out costly rings, jewels, and objects made of gold to the throngs who visit him daily and who venerate him as a saint. He also materializes vast quantities of food, and when the various delicacies he produces fall from his hands they are sizzling hot, so hot that people sometimes cannot even hold them. He can make sweet syrups and fragrant oils pour from his hands (and even his feet), and when he is finished there is no trace of the sticky substance on his skin. He can produce exotic objects such

as grains of rice with tiny, perfectly carved pictures of Krishna on them, out-of-season fruits (a near impossibility in an area of the country that has no electricity or refrigeration), and anomalous fruits, such as apples that, when peeled, turn out to be an apple on one side and another fruit on the other.

Equally astonishing are his productions of sacred ash. Every time he walks among the crowds that visit him, prodigious amounts of it pour from his hands. He scatters it everywhere, into oifered containers and outstretched hands, over heads, and in long serpentine trails on the ground. In a single transit of the grounds around his ashram he can produce enough of it to fill several drums. On one of his visits, Haraldsson, along with Dr. Karlis Osis, the director of research for the American Society for Psychical Research, actually saw some of the ash in the process of materializing. As Haraldsson reports, "His palm was open and turned downwards, and he waved his hand in a few quick, small circles. As he did, a grey substance appeared in the air just below his palm. Dr. Osis, who sat slightly closer, observed that this material first appeared entirely in the form of granules (that crumbled into ash when touched) and might have disintegrated earlier if Sai Baba had produced them by a sleight of hand that was undetectable to us."[59]

Haraldsson notes that Sai Baba's manifestations are not the result of mass hypnosis because he freely allows his open-air demonstrations to be filmed, and everything he does still shows up in the film. Similarly, the production of specific objects, the rarity of some of the objects, the hotness of the food, and the sheer volume of the materializations seem to ruie against deception as a possibility. Haraldsson also points out that no one has ever come forth with any credible evidence that Sai Baba is faking his abilities, in addition, Sai Baba has been producing a continuous flow of objects for half a century, since he was fourteen, a fact that is further testament to both the volume of the materializations and the significance of his untarnished reputation. Is Sai Baba producing objects out of nothingness? At present the jury is still out, but Haraldsson makes it clear what his position is. He believes Sai Baba's demonstrations remind us of the "enormous potentials that may lie dormant somewhere within all human beings."[60]

Accounts of individuals who can materialize are not unknown in India. In his book *Autobiography of a Yogi,* Paramahansa Yoga-nanda (1893-1952), the first eminent holy man of India to set up permanent residence in the West, describes his meetings with several Hindu

ascetics who could materialize out-of-season fruits, gold plates, and other objects. Interestingly, Yogananda cautioned that such powers, or *siddis,* are not always evidence that the person possessing them is spiritually evolved. "The world [is] nothing but an objectivized dream," says Yogananda, and "whatever your powerful mind believes very intensely instantly comes to pass."[6'] Have such individuals discovered a way to tap just a little of the enormous sea of cosmic energy that Bohm says fills every cubic centimeter of empty space?

A remarkable series of materializations that has received even greater confirmation than that bestowed by Haraldsson on Sai Baba was produced by Therese Neumann. In addition to her stigmata, Neumann also displayed *inedia,* the supernormal ability to live without food. Her inedia began in 1923 when she "transferred" the throat disease of a young priest to her own body and subsisted solely on liquids for several years. Then, in 1927, she gave up both food and water entirely.

When the local bishop in Regensburg first learned of Neumann's fast, he sent a commission into her home to investigate. From July 14, 1927, to July 29, 1927, and under the supervision of a medical doctor named Seidl, four Franciscan nursing sisters scrutinized her every move. They watched her day and night, and the water she used for washing and rinsing her mouth was carefully measured and weighed. The sisters discovered several unusual things about Neumann. She never went to the bathroom (even after a period of six weeks she only had one bowel movement, and the excrement, examined by a Dr. Reismanns, contained only a small amount of mucus and bile, but no traces of food). She also showed no signs of dehydration, even though the average human expels about four hundred grams (fourteen ounces) of water daily in the air he or she exhales, and a like amount through the pores. And her weight remained constant; although she lost nearly nine pounds (in blood) during the weekly opening of her stigmata, her weight returned to normal within a day or two later.

At the end of the inquiry Dr. Seidl and the sisters were completely convinced that Neumann had not eaten or drunk a thing for the entire fourteen days. The test seems conclusive, for while the human body can survive two weeks without food, it can rarely survive half that time without water. Yet this was nothing for Neumann; *she did not eat or drink a thing for the next thirty-five years.* So it appears that she was not only materializing the enormous amount of blood necessary to perpetuate her stigmata, but also regularly materializing the

water and nutrients she needed to stay alive and in good health. Inedia is not unique to Neumann. In *The Physical Pkenomena of Mysticism,* Thurston gives several examples of stigmatists who went for years without eating or drinking.

Materialization may be more common than we realize. Compelling accounts of bleeding statues, paintings, icons, and even rocks that have historical or religious significance abound in the literature on the miraculous. There are also dozens of stories of Madonnas and other icons shedding tears. A virtual epidemic of "weeping Madonnas" swept Italy in 1953.[6]- And in India, followers of Sai Baba showed Haraldsson pictures of the ascetic that were miraculously exuding sacred ash.

Changing the Whole Picture

In a way materialization challenges our conventional ideas about reality most of all, for although we can, with effort, hammer things such as PK into our current world view, the creation of an object out of thin air rocks the very foundation of that world view. Still, it is not all the mind can do. So far we have looked at miracles that involve only "parts" of reality—examples of people psychokine tic ally moving parts around, of people altering parts (the laws of physics) to make themselves immune to fire, and of people materializing parts {blood, salt, stones, jewelry, ash, nutrients, and tears). But if reality is really an unbroken whole, why do miracles seem to involve only parts?

If miracles are examples of the mind's own latent abilities, the answer, of course, is because we ourselves are so deeply programmed to see the world in terms of parts. This implies that if we were not so inculcated in thinking in terms of parts, if we viewed the world differently, miracles would also be different. Bather than finding so many examples of miracles in which the parts of reality had been transformed, we would find more instances in which the whole of reality had been transformed. In fact a few such examples exist, but they are rare and offer an even graver challenge to our conventional ideas about reality than materializations do.

Watson provides one. While he was in Indonesia he also encountered another young woman with power. The woman's name was Tia, but unlike Alin's power, hers did not seem to be an expression of an unconscious psychic gift. Instead it was consciously controlled and

stemmed from Tia's natural connection to forces that lie dormant in most of us. Tia was, in short, a shaman in the making. Watson witnessed many examples of her gifts. He saw her perform miraculous healings, and once, when she was engaged in a power struggle with the local Moslem religious leader, he saw her use the power of her mind to set the minaret of the local mosque on fire.

But he witnessed one of Tia's most awesome displays when he accidentally stumbled upon her talking with a little girl in a shady grove of *kenari* trees. Even at a distance, Watson could tell from Tia's gestures that she was trying to communicate something important to the child. Although he could not hear their conversation, he could tell from her air of frustration that she was not succeeding. Finally, she appeared to get an idea and started an eerie dance.

Entranced, Watson continued to watch as she gestured toward the trees, and although she scarcely seemed to move, there was something hypnotic about her subtle gesticulations. Then she did something that both shocked and dismayed Watson. She caused the entire grove of trees suddenly to blink out of existence. As Waison states, "One moment Tia danced in a grove of shady *kenari;* the next she was standing alone in the hard, bright light of the sun."[63]

A few seconds later she caused the grove to reappear, and from the way the little girl leapt to her feet and rushed around touching the trees, Watson was certain that she had shared the experience also. But Tia was not finished. She caused the grove to blink on and off several times as both she and the little girl linked hands, dancing and giggling at the wonder of it all. Watson simply walked away, his head reeling.

In 1975 when I was a senior at Michigan State University I had a similarly profound and reality-challenging experience. I was having dinner with one of my professors at a local restaurant, and we were discussing the philosophical implications of Carlos Castaneda's experiences. In particular our conversation centered around an incident Cas-taneda relates in *Journey to Ixtlan.* Don Juan and Castaneda are in the desert at night searching for a spirit when they come upon a creature that looks like a calf but has the ears of a wolf and the beak of a bird. It is curled up and screaming as if in the throes of an agonizing death.

At first Castaneda is terrified, but after telling himself that what he is seeing can't possibly be real, his vision changes and he sees that the dying spirit is actually a fallen tree branch trembling in the wind. Castaneda proudly points out the thing's true identity, but as usual the

oid Yaqui shaman rebukes him. He tells Castaneda that the branch *was* a dying spirit while it was alive with power, but that it had transformed into a tree branch when Castaneda doubted its existence. However, he stresses that both realities were equally real.

In my conversation with my professor, I admitted that I was intrigued by Don Juan's assertion that two mutually exclusive realities could each be real and felt that the notion could explain many paranormal events. Moments after discussing this incident we left the restaurant and, because it was a clear summer night, we decided to stroll. As we continued to converse I became aware of a small group of people walking ahead of us. They were speaking an unrecognizable foreign language, and from their boisterous behavior it appeared that they were drunk. In addition, one of the women was carrying a green umbrella, which was strange because the sky was totally cloudless and there had been no forecast of rain.

Not wanting to collide with the group, we dropped back a little, and as we did, the woman suddenly began swinging the umbrella in a wild and erratic manner. She traced out huge arcs in the air, and several times as she spun around, the tip of the umbrella nearly grazed us. We slowed our pace even more, but it became increasingly apparent that her performance was designed to attract our attention. Finally, after she had our gaze firmly fixed on what she was doing, she held the umbrella with both hands over her head and then threw it dramatically at our feet.

We both stared at it dumbly, wondering why she had done such a thing, when suddenly something remarkable began to happen. The umbrella did something that I can only describe as "flickering" like a lantern flame about to go out. It emitted an odd, crackling sound like the sound of cellophane being crumpled, and in a dazzling array of sparkling, multicolored light, its ends curled up, its color changed, and it reshaped itself into a gnarled, brown-gray stick. I was so stunned I didn't say anything for several seconds. My professor spoke first and said in a quiet, shocked voice that she had thought the object had been an umbrella. I asked her if she had seen something extraordinary happen and she nodded. We both wrote down what we thought had transpired and our accounts matched exactly. The only vague difference in our descriptions was that my professor said the umbrella had "sizzled" when it transformed into a stick, a sound not too terribly dissimilar from the crackly sound of cellophane being crumpled.

What Does It All Mean?

This incident raises many questions for which I have no answers. I do not know who the people were who threw the umbrella at our feet, or if they were even aware of the magical transformation that took place as they strolled away, although the woman's bizarre and seemingly purposeful performance suggests that they were not completely unwitting. Both my professor and I were so transfixed by the magical transformation of the umbrella that by the time we had the presence of mind to ask them, they were long gone. I do not know why the event happened, save that it seems obvious it was connected in some way to our talk about Castaneda encountering a similar occurrence.

I do not even know why I have had the privilege of experiencing so many paranormal occurrences, save that it appears to be related to the fact that I was born with a great deal of native psychic ability. As an adolescent I started having vivid and detailed dreams about events that would later happen. I often knew things about people I had no right knowing. When I was seventeen I spontaneously developed the ability to see an energy field, or "aura," around living things, and to this day can often determine things about a person's health by the pattern and colors of the mist of light that I see surrounding them. Above and beyond that, all I can say is that we are all gifted with different aptitudes and qualities. Some of us are natural artists. Some dancers. I seem to have been born with the chemistry necessary to trigger shifts in reality, to catalyze somehow the forces required to precipitate paranormal events. 1 am grateful for this capacity because it has taught me a great deal about the universe, but I do not know why I have it.

What I do know is that the "umbrella incident," as I have come to call it, entailed a radical alteration in the world. In this chapter we have looked at miracles that have involved increasingly greater shifts in reality. PK is easier for us to fathom than the ability to pluck an object out of the air, and the materialization of an object is easier for most of us to accept than the appearance and disappearance of an entire grove of trees, or the paranormal appearance of a group of people capable of transmogrifying matter from one form into another. More and more these incidents suggest that reality is, in a very real sense, a hologram, a construct.

The question becomes, Is it a hologram that is relatively stable for

long periods of time and subject to only minimal alterations by consciousness, as Bohm suggests? Or is it a hologram that only seems stable, but under special circumstances can be changed and reshaped in virtually limitless ways, as the evidence of the miraculous suggests? Some researchers who have embraced the holographic idea believe the latter is the ease. For example, Grof not only takes materialisation and other extreme paranormal phenomena seriously, but feels that reality is indeed cloud-built and pliant to the subtle authority of consciousness. "The world is not necessarily as solid as we perceive it," he says.[M]

Physicist William Tiller, head of the Department of Materials Science at Stanford University and another supporter of the holographic idea, agrees. Tiller thinks reality is similar to the "holodeck" on the television show *Star Trek: The Next Generation.* In the series, the holodeck is an environment in which occupants can call up a holographic simulation of literally any reality they desire, a lush forest, a bustling city. They can also change each simulation in any way they want, such as cause a lamp to materialize or make an unwanted table disappear. Tiller thinks the universe is also a kind of holodeck created by the "integration" of all living things. "We've created it as a vehicle of experience, and we've created the laws that govern it," he asserts. "And when we get to the frontiers of our understanding, we can in fact shift the laws so that we're also creating the physics as we go along."[65]

If Tiller is right and the universe is an enormous holodeck, the ability to materialize a gold ring or cause a grove of *kenari* trees to flick on and off is no longer so strange. Even the umbrella incident can be viewed as a temporary aberration in the holographic simulation we call ordinary reality. Although my professor and I were unaware that we possessed such an ability, it may be that the emotional fervor of our discussion about Castaneda caused our unconscious minds to change the hologram of reality to better reflect what we were believing at the moment. Given Ullman's assertion that our psyche is constantly trying to teach us things we are unaware of in our waking state, our unconscious may even be programmed to produce occasionally such miracles in order to offer us glimpses of reality's true nature, to show us that the world we create for ourselves is ultimately as creatively infinite as the reality of our dreams.

Saying that reality is created by the integration of all living things is really no different from saying that the universe is comprised of

reality fields. If this is true, it explains why the reality of some subatomic particles, such as electrons, seems relatively fixed, while the reality of others, such as anomalons, appears to be more plastic. It may be that the reality fields we now perceive as electrons became part of the cosmic hologram long ago, perhaps long before human beings were even part of the integration of all things. Hence, electrons may be so deeply ingrained in the hologram they are no longer as susceptible to the influence of human consciousness as other newer reality fields. Similarly, anomalons may vary from lab to lab *because* they are more recent reality fields and are still inchoate, still floundering around in search of an identity, as it were. In a sense, they are like the champagne beach Tart's subjects perceived while it was still in its gray state and had not yet fully coalesced out of the implicate.

This may also explain why aspirin helps prevent heart attacks in Americans, but not in the British. It, too, may be a relatively recent reality field and one that is still in the making. There is even evidence that the ability to materialize blood is a comparatively recent reality field. Rogo notes that accounts of blood miracles began with the fourteenth-century miracle of San Gennaro. The fact that no blood miracles are known to predate San Gennaro seems to indicate that the ability flickered into existence at that time. Once it was thus established it would be easier for others to tap into the reality field of its possibility, which may explain why there have been numerous blood miracles since San Gennaro, but none before.

Indeed, if the universe is a holodeck, all things that appear stable and eternal, from the laws of physics to the substance of galaxies, would have to be viewed as reality fields, will-o'-the-wisps no more or less real than the props in a giant, mutually shared dream. All permanence would have to be looked at as illusory, and only consciousness would be eternal, the consciousness of the living universe.

Of course, there is one other possibility. It may be that only anomalous events, such as the umbrella incident, are reality fields, and the world at large is still every bit as stable and unaffected by consciousness as we have been taught to believe. The problem with this assumption is that it can never be proved. The only litmus test we have of determining whether something is real, say a purple elephant that has just strolled into our living room, is to find out if other people can see it as well. But once we admit that two or more people can create a reality—whether it is a transforming umbrella or a vanishing grove of *kenari* trees—we no longer have any way of proving that every-

thing else in the world is not created by the mind. It all boils down to a matter of personal philosophy.

And personal philosophies vary. Jahn prefers to think that only the reality created by the interactions of consciousness are real. "The question of whether there's an 'out there' out there is abstract. If we have no way of verifying the abstraction, there is no profit in attempting to model it," he says.[66] Globus, who willingly admits that reality is a construct of consciousness, prefers to think that there is a world beyond the bubble of our perceptions. "I'm interested in nice theories," he says, "and a nice theory postulates existence."[67] However, he admits that this is merely his bias, and there is no empirical way to prove such an assumption.

As for me, as a result of my own experiences I agree with Don Juan when he states, "We are perceivers. We are an awareness; we are not objects; we have no solidity. We are boundless. The world of objects and solidity is a way of making our passage on earth convenient. It is only a description that was created to help us. We, or rather our *reason,* forget that the description is only a description and thus we entrap the totality of ourselves in a vicious circle from which we rarely emerge in our lifetime."[68]

Put another way, there is *no* reality above and beyond that created by the integration of all consciousnesses, and the holographic universe can potentially be sculpted in virtually limitless ways by the mind.

If this is true, the laws of physics and the substance of galaxies are not the only things that are reality fields. Even our bodies, the vehicles of our consciousness in this life, would have to be looked upon as no more or less real than anomalous and champagne beaches. Or as Keith Floyd, a psychologist at Virginia Intermont College and another supporter of the holographic idea, states, "Contrary to what everyone knows is so, it may not be the brain that produces consciousness, but rather consciousness that creates the appearance of the brain—matter, space, time and everything else we are pleased to interpret as the physical universe,"[69]

This is perhaps most disturbing of all, for we are so deeply convinced that our bodies are solid and objectively real it is difficult for us even to entertain the idea that we, too, may be no more than will-o'-the-wisps. But there is compelling evidence that this is also the case. Another phenomenon often associated with saints is *bilocation,* or the ability to be in two places at once. According to Haraldsson, Sai Baba does biolocation one better. Numerous witnesses have reported

watching him snap his fingers and vanish, instantly reappearing a hundred or more yards away. Such incidents very much suggest that our bodies are not objects, but holographic projections that can blink "off" in one location and "on" in another with the same ease that an image might vanish and reappear on a video screen.

An incident that further underscores the holographic and immaterial nature of the body can be found in phenomena produced by an Icelandic medium named Indridi Indridason. In 1905 several of Iceland's leading scientists decided to investigate the paranormal and chose Indridason as one of their subjects. At the time, Indridason was just a country bumpkin with no previous experience with things psychic, but he quickly proved to be a spectacularly talented medium. He could go into trance quickly and produce dramatic displays of PK. But most bizarre of all, sometimes while he was deep in trance, different parts of his body would completely dematerialize. As the astonished scientists watched, an arm or a hand would fade out of existence, only to re materialize before he awakened.[70]

Such events again offer us a tantalizing glimpse of the enormous potentialities that may lie dormant in all of us. As we have seen, our current scientific understanding of the universe is completely incapable of explaining the various phenomena we have examined in this chapter and therefore has no choice but to ignore them. However, if researchers such as Grof and Tiller are correct and the mind is able to intercede in the implicate order, the holographic plate that gives birth to the hologram we call the universe, and thus create any reality or laws of physics that it wants to, then not only are such things possible, but virtually anything is possible.

If this is true, the apparent solidity of the world is only a small part of what is available to our perception. Although most of us are indeed entrapped in our current description of the universe, a few individuals do have the ability to see beyond the world's solidity. In the *next* chapter we will take a look at some of these individuals and examine what they see.

6

Seeing Holographically

We human beings consider ourselves to be made up of "solid matter." Actually, *the physical body is the end product,* so to speak, of the subtle information fields, which mold our physical body as wed as all physical matter. These fields ore holograms which change in time (and are) outside the reach of our normal senses. This is what clairvoyants perceive as colorful egg-shaped halos or auras surrounding our physical bodies.

—*Hzhak* Bentov
Stalking the Wild Pendulum

A number of years ago I was walking along with a friend when a street sign caught my attention. It was simply a No Parking sign and seemed no different from any of the other No Parking signs that dotted the city streets. But for some reason it held me transfixed. I wasn't even aware that I was staring at it until my friend suddenly exclaimed, "That sign is misspelled!" Her announcement snapped me out of my reverie, and as I watched, the *i* in the word *Parking* quickly changed into an *e.*

What happened was that my mind was so accustomed to seeing the sign spelled correctly that my unconscious edited out what was there and made me see what it expected to be there. My friend, as it turned out, had also seen the sign spelled correctly at first, which was why she had such a vocal reaction when she realized it was misspelled. We

continued to walk on, but the incident bothered roe. For the first time I realized that the eye/brain is not a faithful camera, but tinkers with the world before it gives it to us.

Neurophysiologists have long been aware of this fact In his early studies of vision, Pribram discovered that the visual information a monkey receives via its optic nerves does not travel directly into its visual cortex, but is first filtered through other areas of its brain.[1] Numerous studies have shown that the same is true of human vision. Visual information entering our brains is edited and modified by our temporal lobes before it is passed on to our visual cortices. Some studies suggest that less than 50 percent of what we "see" is actually based on information entering our eyes. The remaining 50 percent plus is pieced together out of our expectations of what the world should look like {and perhaps out of other sources such as reality fields). The eyes may be visual organs, but it is the brain that sees.

This is why we don't always notice when a close friend shaves off his mustache, and why our house always looks strangely different when we return to it after a vacation. In both instances we are so used to responding to what we think is there, we don't always see what really is there.

Even more dramatic evidence of the role the mind plays in creating what we see is provided by the eye's so-called blind spot. In the middle of the retina, where the optic nerve connects to the eye, we have a blind spot where there are no photoreceptors. This can be quickly demonstrated with the illustration shown in figure 15.

Even when we look at the world around us we are totally unaware that there are gaping holes in *our* vision. It doesn't matter whether we are gazing at a blank piece of paper or an ornate Persian carpet The brain artfully fills in the gaps like a skilled tailor reweaving a hole in a piece of fabric. What is all the more remarkable is that it reweaves the tapestry of our visual reality so masterfully we aren't even aware that it is doing so.

This leads to a disturbing question. If we are seeing less than half of what is out there, what is out there that we are not seeing? What misspelled street signs and blind spots are escaping our attention completely? Our technological prowess provides us with a few answers. For example, although spiderwebs look drab and white to us, we now know that to the ultraviolet-sensitive eyes of the insects for whom they were designed, they are actually brightly colored and hence alluring. Our technology also tells us that fluorescent lamps do

FIGURE 15. To demonstrate how our brains construct what we perceive as reality, hold the illustration at eye level, close your left eye, and stare at the circle in the middle of the grid with your right eye. Slowly move the book back and forth along the line of your vision until the star vanishes (about 10 to 15 inches). The star disappears because it is falling on your blind spot. Now close your right eye and stare at the star. Move the book back and forth until the circle in the middle of the grid vanishes. When it does, notice that although the circle disappears, all the lines of the grid remain intact. This is because your brain is filling in what it thinks should be there.

not continuously provide light, but are actually flickering on and off at a rate that is just a little too fast for us to discern. Yet this unsettling strobelike effect is quite visible to honeybees, who must be able to fly at breakneck speed over a meadow and still see every flower that whizzes by.

But are there other important aspects of reality that we are not seeing, aspects that are beyond even our technological grasp? According to the holographic model, the answer is yes. Remember that in Pribram's view, reality at large is really a frequency domain, and our brain is a kind of lens that converts these frequencies into the objective world of appearances. Although Pribram began by studying the frequencies of our normal sensory world, such as frequencies of sound and light, he now uses the *term frequency domain* to refer to the interference patterns that compose the implicate order.

Pribram believes there may be all kinds of things out there in the frequency domain that we are not seeing, things our brains have learned to edit out regularly of our visual reality. He thinks that when

mystics have transcendental experiences, what they are really doing is catching glimpses of the frequency domain. "Mystical experience makes sense when one can provide the mathematical formulas that take one back and forth between the ordinary world, or 'image-object' domain, and the 'frequency' domain," he states.[2]

The Human Energy Field

One mystical phenomenon that appears to involve the ability to see reality's frequency aspects is the aura, or human energy field. The notion that there is a subtle field of energy around the human body, a halolike envelope of light that exists just beyond normal human perception, can be found in many ancient traditions. In India, sacred writings that date back over five thousand years refer to this life energy as *prana.* In China, since the third millennium B.C., it has been called *ch 'i* and is believed to be the energy that flows through the acupuncture meridian system. Kabbalah, a Jewish mystical philosophy that arose in the sixth century B.C., calls this vital principle *nefish* and teaches that an egg-shaped bubble of iridescence surrounds every human body. In their book *Future Science,* writer John White and parapsychologist Stanley Krippner list 97 different cultures that refer to the aura with 97 different names.

Many cultures believe the aura of an extremely spiritual individual is so bright it is visible even to normal human perception, which is why so many traditions, including Christian, Chinese, Japanese, Tibetan, and Egyptian, depict saints as having halos or other circular symbols around their heads. In his book on miracles Thurston devotes an entire chapter to accounts of luminous phenomena associated with Catholic saints, and both Neumann and Sai Baba are reported to have occasionally had visible auras of light around them. The great Sufi mystic Hazrat Inayat Khan, who died in 1927, is said to have sometimes given off so much light that people could actually read *by* it.[3]

Under normal circumstances, however, the human energy field is visible only to individuals who have a specially developed capacity to see it. Sometimes people are bom with the ability. Sometimes it develops spontaneously at a certain point in a person's life, as it did in my case, and sometimes it develops as the result of some practice or discipline, often of a spiritual nature. The first time I saw the distinc-

tive mist of light around my arm I thought it was smoke and jerked *my arm* up *to* see if I had somehow caught my sleeve *on* fire. Of course, I hadn't and quickly discovered that the light surrounded my entire body and formed a nimbus around everyone else's as well.

According to some schools of thought the human energy field has a number of distinct layers. I do not see layers in the field and have no personal basis to judge if this is true or not. These layers are actually said to be three-dimensional energy bodies that occupy the same space as the physical body but are of increasingly larger size so that they only look like layers, or strata, as they extend outward from the body.

Many psychics assert that there are seven main layers, or subtle bodies, each progressively less dense than the one before it, and each increasingly more difficult to see. Different schools of thought refer to these energy bodies by different names. One common system of nomenclature refers to the first four as the etheric body; the astral, or emotional body; the mental body, and the causal, or intuitive body. It is generally believed that the etheric body, the body that is closest in size to the physical body, is a kind of energy blueprint and is involved in guiding and shaping the growth of the physical body. As their names suggest, the next three bodies are related to emotional, mental, and intuitive processes. Virtually no one agrees on what to call the remaining three bodies, although it is commonly agreed that they have to do with the soul and higher spiritual functioning.

According to Indian yogic literature, and to many psychics as well, we also have special energy centers in our body. These focal points of subtle energy are connected to endocrine glands and major nerve centers in the physical body, but also extend up and into the energy field. Because they resemble spinning vortices of energy when they are looked at head-on, yogic literature refers to them as *chakras,* from the Sanskrit word for "wheel," and this term is still used today.

The crown chakra, an important chakra that originates in the uppermost tip of the brain and is associated with spiritual awakening, is often described by clairvoyants as looking like a little cyclone whirling in the energy field on top of the head, and it is the only chakra I see clearly. (My own abilities appear to be too rudimentary to permit me to see the other chakras.) It ranges from a few inches to a foot or more in height. When people are in a joyous state, this whirlwind of energy grows taller and brighter, and when they dance, it bobs and sways like a candle flame. I've often wondered if this was what the apostle Luke

was seeing when he described the "flame of the Pentecost," the tongues of fire that appeared on the heads of the apostJes when the Holy Ghost descended on them.

The human energy field is not always bluish white, but can possess various colors. According to talented psychics, these colors, their mud-diness or intensity, and their location in the aura are related to a person's mental state, emotional state, activity, health, and assorted other factors. I can only see colors occasionally and sometimes can interpret their meaning, but again my abilities in this area are not terribly advanced.

One person who does have advanced abilities is therapist and healer Barbara Brennan. Brennan began her career as an atmospherics physicist working for NASA at the Goddard Space Flight Center, and later left to become a counselor. Her first inkling that she was psychic came when she was a child and discovered she could walk blindfolded through the woods and avoid the trees simply by sensing their energy fields with her hands. Several years after she became a counselor, she began seeing halos of colored light around people's heads. After overcoming her initial shock and skepticism, she set about to develop the ability and eventually discovered she had an extraordinary natural talent as a healer.

Brennan not only sees the chakras, layers, and other fine structures of the human energy field with exceptional clarity, but can make startiingly accurate medical diagnoses based on what she sees. After looking at one woman's energy field, Brennan told her there was something abnormal about her uterus. The woman then told Brennan that her doctor had discovered the same problem, and it had already caused her to have one miscarriage. In fact, several physicians had recommended a hysterectomy and that was why she was seeking Brennan's counsel. Brennan told her that if she took a month off and took care of herself, her problem would clear up. Brennan's advice turned out to be correct, and a month later the woman's physician confirmed that her uterus had returned to normal. A year later the woman gave birth to a healthy baby boy."[1]

In another case Brennan was able to see that a man had problems performing sexually because he had broken his coccyx (tailbone) when he was twelve. The still out-of-place coccyx was applying undue pressure to his spinal column, and this in turn was causing his sexual dysfunction.[5]

There seems to be little Brennan cannot pick up by looking at the

human energy field. She says that in its early stages cancer looks gray-blue in the aura, and as it progresses, it turns to black. Eventually, white spots appear in the black, and if the white spots sparkle and begin to look as if they are erupting from a volcano, it means the cancer has metastasized. Drugs such as alcohol, marijuana, and cocaine are also detrimental to the brilliant, healthy colors of the aura and create what Brennan calls "etheric mucus." In one instance she was able to tell a startled client which nostril he habitually used to snort cocaine because the field over that side of his face was always gray with the sticky etheric mucus.

Prescription drugs are not exempt, and often cause dark areas to form in the energy field over the liver. Potent drugs such as chemotherapy "clog" the entire field, and Brennan says she has even seen auric traces of the supposedly harmless radiopaque dye used to diagnose spinal injuries, a full ten years after it has been injected into a person's spine. According to Brennan, a person's psychological condition is also reflected in their energy field. An individual with psychopathic tendencies has a top-heavy aura. The energy field of a masochistic personality is coarse and dense and is more gray than blue. The field of a person with a rigid approach to life is also coarse and grayish, but with most of its energy concentrated on the outer edge of the aura, and so on.

Brennan says that illness can actually be caused by tears, blockages, and imbalances in the aura, and by manipulating these dysfunctional areas with her hands and her own energy field, she can greatly enhance a person's own healing processes. Her talents have not gone unnoticed. Swiss psychiatrist and thanatologist Elisabeth Kubler-Ross says Brennan is "probably one of the best spiritual healers in the Western Hemisphere."[6] Bernie Siege? is equally iaudatory: "Barbara Brennan's work is mind opening. Her concepts of the role disease plays and how healing is achieved certainly fitin with my experience."[7]

As a physicist, Brennan is keenly interested in describing the human energy field in scientific terms and believes Pribram's assertion that there is a frequency domain beyond our field of normal perception is the best scientific model we have so far for understanding the phenomenon. "From the point of view of the holographic universe, these events [the aura and the healing forces required to manipulate its energies] emerge from frequencies that transcend time and space; they don't have to be transmitted. They are potentially simultaneous and everywhere," she says."

That the human energy field exists everywhere and is nonlocal until it is plucked out of the frequency domain by human perception is evidenced in Brennan's discovery that she can read a person's aura even when the person is many miles distant. The longest-distance aura reading she has done so far was during a telephone conversation between New York City and Italy. She discusses this, as well as many other aspects of her remarkable abilities, in her recent and fascinating book *Hands of Light.*

The Energy Field of the Human Psyche

Another gifted psychic who can see the aura in great detail is Los Angeles-based "human energy field consultant" Carol Dryer. Dryer says she has been able to see auras for as long as she can remember, and indeed it was quite some time before she realized other people couldn't see auras. Her ignorance in this regard frequently landed her in trouble as a child when she would tell her parents intimate details about their friends, things she had no apparent way of knowing.

Dryer makes her living as a psychic, and in the past decade and a half has seen over five thousand clients. She is well known in the media because her client list inclodes many celebrities such as Tina Turner, Madonna, Rosanna Arquette, Judy Collins, Valerie Harper, and Linda Gray. But even the star power of her client list does not begin to convey the true extent of her talent. For instance, Dryer's client list also includes physicists, noted journalists, archaeologists, lawyers, and politicians, and she has used her abilities to assist the police and frequently does consultation work for psychologists, psychiatrists, and medical doctors.

Like Brennan, Dryer can give long-distance readings, but prefers to be in the same room with the person. She can also see a person's energy field as well with her eyes closed as she can with her eyes open. In fact, she generally keeps her eyes closed during a reading to help her concentrate solely on the energy field. This does not mean that she sees the aura only in her mind's eye. "It's always in front of me as if I'm looking at a movie or a play," says Dryer. "It's as real as the room I'm sitting in. Actually, it's more real and more brightly colored."[9]

However, she does not see the precise stratified layers described by other clairvoyants, and she often doesn't even see the outline of the

human energy field. She says that in its early stages cancer looks gray-blue in the aura, and as it progresses, it turns to black. Eventually, white spots appear in the black, and if the white spots sparkle and begin to look as if they are erupting from a volcano, it means the cancer has metastasized. Drugs such as alcohol, marijuana, and cocaine are also detrimental to the brilliant, healthy colors of the aura and create what Brennan calls "etheric mucus." In one instance she was able to tell a startled client which nostril he habitually used to snort cocaine because the field over that side of his face was always gray with the sticky etheric mucus.

Prescription drugs are not exempt, and often cause dark areas to form in the energy field over the liver. Potent drugs such as chemotherapy "clog" the entire field, and Brennan says she has even seen auric traces of the supposedly harmless radiopaque dye used to diagnose spinal injuries, a full ten years after it has been injected into a person's spine. According to Brennan, a person's psychological condition is also reflected in their energy field. An individual with psychopathic tendencies has a top-heavy aura. The energy field of a masochistic personality is coarse and dense and is more gray than blue. The field of a person with a rigid approach to life is also coarse and grayish, but with most of its energy concentrated on the outer edge of the aura, and so on.

Brennan says that illness can actually be caused by tears, blockages, and imbalances in the aura, and by manipulating these dysfunctional areas with her hands and her own energy field, she can greatly enhance a person's own healing processes. Her talents have not gone unnoticed. Swiss psychiatrist and thanatologist Elisabeth Kubler-Ross says Brennan is "probably one of the best spiritual healers in the Western Hemisphere."[6] Bernie Sieget is equally taudatory: "Barbara Brennan's work is mind opening. Her concepts of the role disease plays and how healing is achieved certainly fit in with my experience."[7]

As a physicist, Brennan is keenly interested in describing the human energy field in scientific terms and believes Pribram's assertion that there is a frequency domain beyond our field of normal perception is the best scientific model we have so far for understanding the phenomenon. "From the point of view of the holographic universe, these events [the aura and the healing forces required to manipulate its energies] emerge from frequencies that transcend time and space; they don't have to be transmitted. They are potentially simultaneous and everywhere," she says."

That the human energy field exists everywhere and is nonlocal until it is plucked out of the frequency domain by human perception is evidenced in Brennan's discovery that she can read a person's aura even when the person is many miles distant. The longest-distance aura reading she has done so far was during a telephone conversation between New York City and Italy. She discusses this, as well as many other aspects of her remarkable abilities, in her recent and fascinating book *Hands of Light*

The Energy Field of the Human Psyche

Another gifted psychic who can see the aura in great detail is Los Angeles-based "human energy field consultant" Carol Dryer. Dryer says she has been able to see auras for as long as she can remember, and indeed it was quite some time before she realized other people couldn't see auras. Her ignorance in this regard frequently landed her in trouble as a child when she would tell her parents intimate details about their friends, things she had no apparent way of knowing.

Dryer makes her living as a psychic, and in the past decade and a half has seen over five thousand clients. She is well known in the media because her client list includes many celebrities such as Tina Turner, Madonna, Rosanna Arquette, Judy Collins, Valerie Harper, and Linda Gray. But even the star power of her client list does not begin to convey the true extent of her talent. For instance, Dryer's elient list also includes physicists, noted journalists, archaeologists, lawyers, and politicians, and she has used her abilities to assist the police and frequently does consultation work for psychologists, psychiatrists, and medical doctors.

Like Brennan, Dryer can give long-distance readings, but prefers to be in the same room with the person. She can also see a person's energy field as well with her eyes closed as she can with her eyes open. In fact, she generally keeps her eyes closed during a reading to help her concentrate solely on the energy field. This does not mean that she sees the aura only in her mind's eye. "It's always in front of me as if Fm looking at a movie or a play," says Dryer. "It's as real as the room I'm sitting in. Actually, it's more real and more brightly colored."[9]

However, she does not see the precise stratified layers described by other clairvoyants, and she often doesn't even see the outline of the

physical body. "A person's physical body can come into it, but rarely because that's seeing the etheric body rather than seeing the aura or the energy field around them. If I'm seeing the etheric, it's usually because it contains leaks or rips that are keeping the aura from being whole. Thus I cannot see it completely. There are only patches of it. It's kind of like a ripped blanket or a torn curtain. Holes in the etheric field are usually the result of trauma, injury, illness, or some other kind of devastating experience."

But beyond seeing the etheric, Dryer says that instead of seeing the layers of the aura like tiers of cake piled one on top of the other, she *experiences* them as changing textures and intensities of visual sensation. She compares this to being immersed in the ocean and feeling water of different temperatures wash by. "Rather than getting into rigid concepts like layers, I tend to see the energy field in terms of movements and waves of energy," she says. "It's as if my vision is telescoping through various levels and dimensions of the energy field, but I don't actually see it neatly arranged in various layers."

This does not mean that Dryer's perception of the human energy field is in any way less detailed than Brennan's. She perceives a dazzling amount of pattern and structure—kaleidoscopic clouds of color shot through with light, complex images, glistening shapes, and gossamer mists. However, not all energy fields are created equal. According to Dryer, shallow people have shallow and humdrum auras. Conversely, the more complex the person, the more complex and interesting their energy field. "A person's energy field is as individual as their fingerprint. I've never really seen any two that look alike," she says.

Like Brennan, Dryer can diagnose illnesses by looking at a person's aura, and when she chooses she can adjust her vision and see the chakras. But Dryer's special skill is the ability to peer deep into a person's psyche and give them an eerily accurate status report of the weaknesses, strengths, needs, and general health of their emotional, psychological, and spiritual being. So profound are her talents in this area that some have likened a session with Dryer to six months of psychotherapy. Numerous clients have credited her with completely transforming their lives, and her files are filled with glowing letters of thanks.

I, too, can attest to Dryer's abilities. In my first reading with her, and although we were virtual strangers, she proceeded to describe things about me that not even my closest friends know. These were

not just vague platitudes, but specific and detailed assessments of my talents, vulnerabilities, and personality dynamics. By the end of the two-hour session I was convinced that Dryer had not been looking at my physical presence, but at the energy construct of my psyche itself. I have also had the privilege of talking with and/or listening to the session recordings of over two dozen of Dryer's clients, and have discovered that, almost without exception, others have found her as accurate and insightful as did I.

Doctors Who See the Human Energy Field

Although the existence of the human energy field is not recognized by the medical orthodox community, it has not been completely ignored by medical practitioners. One medical professional who takes the energy field seriously is neurologist and psychiatrist Shafica Karagulla. Karagulla received her degree of doctor of medicine and surgery from the American University of Beirut, Lebanon, and obtained her training in psychiatry under the well-known psychiatrist Professor Sir David K. Henderson, at the Royal Edinburgh Hospital for Mental and Nervous Disorders. She also spent three and a half years as a research associate to Wilder Penfietd, the Canadian neurosurgeon whose landmark studies of memory launched both Lashley and Pribram on their quest

Karagulla began as a skeptic, but after encountering several individuals who could see auras, and confirming their ability to make accurate medical diagnoses as a result of what they saw, she became a believer. Karagulla calls the faculty to see the human energy field *higher sense perception,* or HSP, and in the 1960s she set out to determine if any members of the medical profession also possessed the ability. She put out various feelers among her friends and colleagues, but at first the going was slow. Even doctors who were said to have the ability were reluctant to meet with her. After being put off repeatedly by one such doctor, she finally made an appointment to see him as a patient.

She entered his office, but instead of allowing him to perform a physical examination to diagnose her condition, she challenged him to use his higher sense perception. Realizing he was cornered, he gave in. "AH right, stay where you are," he told her. "Don't tell me any-

thing." Then he scanned her body and gave her a quick run-down of her health, including a description of an internal condition she had that would eventually require surgery, a condition she had secretly already diagnosed. He was "correct in every detaii," says Karagulla.[1]"

As Karagulla's network of contacts expanded, she met doctor after doctor with similar gifts and describes these encounters in her book *Breakthrough to Creativity.* Most of these physicians were unaware that other individuals existed who possessed similar talents, and felt they were alone and peculiar in this regard. Nonetheless, they invariably described what they were seeing as an "energy field" or a "moving web of frequency" around the body and interpenetrating the body. Some saw chakras, but because they were ignorant of the term, they described them as "vortices of energy at certain points along the spine, connected with or influencing the endocrine system." And almost without exception they kept their abilities a secret out of fear of damaging their professional reputations.

Out of respect for their privacy, Karagulla identifies them in her book by first name only but says they include famous surgeons, Cornell University professors of medicine, heads of departments in large hospitals, and Mayo Clinic physicians. "I was continually surprised to find how many members of the medical profession had HSP abilities," she writes. "Most of them felt a little uneasy about their gifts, but finding them useful in diagnosis, they used them. They came from many parts of the country, and although they were unknown to each other, they all reported similar types of experiences." At the end of her report, she concludes, "When many reliable individuals independently report the same kind of phenomena, it is time science takes cognizance of it."[11]

Not all health professionals are so opposed to going public with their abilities. One such individual is Dr. Dolores Krieger, a professor of nursing at New York University. Krieger became interested in the human energy field after participating in a study of the abilities of Oscar Estebany, a well-known Hungarian healer. After discovering that Estebany could raise the hemoglobin levels in ill patients simply by manipulating their fields, Krieger set out to learn more about the mysterious energies involved. She immersed herself in a study of *prana,* the chakras, and the aura, and eventually became a student of Dora Kunz, another well-known clairvoyant. Under Kunz's guidance, she learned how to feel blockages in the human energy field and to heal by manipulating the field with her hands.

Realizing the enormous medical potential of Kunz's techniques, Krieger decided to teach what she had learned to others. Because she knew terms such as *aura* and *chakra* would have negative connotations for many health-care professionals, she decided to call her healing method "therapeutic touch." The first class she taught on therapeutic touch was a master's level course for nurses at New York University entitled "Frontiers in Nursing: The Actualization of Potential for Therapeutic Field Interaction." Both the course and the technique proved so successful that Krieger has since taught therapeutic touch to literally thousands of nurses, and it is now used in hospitals around the world.

The effectiveness of therapeutic touch has also been demonstrated in several studies. For example, Dr. Janet Quinn, an associate professor and assistant director of nursing research at the University of South Carolina at Columbia, decided to see if therapeutic touch could lower the anxiety levels of heart patients. To accomplish this she devised a double-blind study in which one group of nurses trained in the technique would pass their hands over a group of heart patients' bodies. A second group with no training would pass their hands over the bodies of another group of heart patients, but without actually performing the technique. Quinn found that the anxiety levels in the authentically treated patients dropped 17 percent after only five minutes of therapy, but there was no change in anxiety levels among the patients who received the "fake" treatment Quinn's study was the lead story in the *Science Times* section of the March 26, 1985, issue of the *New York Times.*

Another health professional who lectures widely about the human energy field is University of Southern California heart and lung specialist *Vf.* Brugh Joy. Joy, who is a graduate of both Johns Hopkins and the Mayo Clinic, discovered his gift .in 1972 while examining a patient in his office. Instead of seeing the aura, Joy initially was only able to feel its presence with his hands. "I was examining a healthy-male in his early twenties," he says. "As my hand passed over the solar plexus area, the pit of the stomach, I sensed something that felt like a warm cloud. It seemed to radiate out three to four feet from the body, perpendicular to the surface and to be shaped like a cylinder about four inches in diameter."[12]

Joy went on to discover that all his patients had palpable cyiinderiike radiations emanating not only from their stomachs, but from various other points on their bodies. It wasn't until he read an ancient Hindu

book about the human energy system that he found he had discovered, or rather rediscovered, the chakras. Like Brennan, Joy thinks the holographic model offers the best explanation for understanding the human energy field. He also feels that the ability to see auras is latent in alt of us. "1 believe that reaching expanded states of consciousness is merely the attuning of our central nervous system to perceptive states that have always existed in us but have been blocked by our outer mental conditioning," says Joy.[13]

To prove his point, Joy now spends most of his time teaching others how to sense the human energy field. One of Joy's students is Michael Crichton, the author of such bestsellers as *The Andromeda Strain* and *Sphere)* and the director of the motion pictures *Coma* and *The First Great Train Robbery.* In his recent bestselling autobiography *Travels,* Crichton, who obtained his medical degree from the Harvard University Medical School, describes how he learned to feel and eventually see the human energy field by studying under both Joy and other gifted teachers. The experience astonished and transformed Crichton. "There isn't any delusion. It is absolutely clear that this body energy is a genuine phenomenon of some kind," he states.[14]

Chaos Holographic Patterns

The increasing willingness of doctors to go public with such abilities is not the only change that has taken place since Karagulla did her investigations. Over the past twenty years Valerie Hunt, a physical therapist and professor of kinesiology at UCLA, has developed a way to confirm experimentally the existence of the human energy field. Medical science has long known that humans are electromagnetic beings. Doctors routinely use electrocardiographs to make electrocar-diograms (EKGs) or records, of the electrical activity of the heart, and electroencephalographs to make electroencephalograms (EEGs) of the brain's electrical activity. Hunt has discovered that an electromyo-graph, a device used to measure the electrical activity in the muscles, can also pick up the electrical presence of the human energy field.

Although Hunt's original research involved the study of human muscular movement, she became interested in the energy field after encountering a dancer who said she used her own energy field to help her dance. This inspired Hunt to make electromyograms (EMGs) of the

electrical activity in the woman's muscies while she danced, and also to study the effect healers had on the electrical activity in the muscles of people being healed. Her research eventually expanded to include individuals who could see the human energy field, and it was here that she made some of her most significant discoveries.

The normal frequency range of the electrical activity in the brain is between 0 and 100 cycles per second (cps), with most of the activity occurring between 0 and 30 cps. Muscle frequency goes up to about 225 cps, and the heart goes up to about 250 cps, but this is where electrical activity associated with biological function drops off. In addition to these, Hunt discovered that the electrodes of the electromyo-graph could pick up another field of energy radiating from the body, much subtler and smaller in amplitude than the traditionally recognized body electricities but with frequencies that averaged between 100 and 1600 cps, and which sometimes went even higher. Moreover, instead of emanating from the brain, heart, or muscles, the field was strongest in the areas of the body associated with the chakras. "The results were so exciting that I simply was not able to sleep that night," says Hunt. "The scientific model I had subscribed to throughout my life just couldn't explain these findings."[15]

Hunt also discovered that when an aura reader saw a particular color in a person's energy field, the electro myograph always picked up a specific pattern of frequencies that Hunt learned to associate with that color. She was able to see this pattern on an oscilloscope, a device that converts electrical waves into a visual pattern on a monochromatic video display screen. For example, when an aura reader saw blue in a person's energy field, Hunt could confirm that it was blue by looking at the pattern on the oscilloscope. In one experiment she even tested eight aura readers simultaneously to see if they would agree with the oscilloscope as well as with each other. "It was the same right down the line," says Hunt.[16]

Once Hunt confirmed the existence of the human energy field, she, too, became convinced that the holographic idea offers one model for understanding it. In addition to its frequency aspects, she points out that the energy field, and indeed all of the body's electrical systems, is holographic in another way. Like the information in a hologram, these systems are distributed globally throughout the body. For instance, the electrical activity measured by an electroencephalograph is strongest in the brain, but an EEG reading can also be made by attaching an electrode to the toe. Similarly, an EKG can be picked up

in the little finger. It's stronger and higher in amplitude in the heart, but its frequency and pattern are the same everywhere in the body. Hunt believes this is significant. Although every portion of what she calls the "holographic field reality" of the aura contains aspects of the whole energy field, different portions are not absolutely identical to each other. These differing amplitudes keep the energy field from being a static hologram, and instead allow it to be dynamic and flowing, says Hunt.

One of Hunt's most startling findings is that certain talents and abilities seem to be related to the presence of specific frequencies in a person's energy field. She has found that when the main focus of a person's consciousness is on the material world, the frequencies of their energy field tend to be in the lower range and are not too far removed from the 250 cps of the body's biological frequencies. In addition to these, people who are psychic or who have healing abilities also have frequencies of roughly 400 to 800 cps in their field. People who can go into trance and apparently channel other information sources through them, skip these "psychic" frequencies entirely and operate in a narrow band between 800 and 900 cps. "They don't have any psychic breadth at all," states Hunt. "They're up there in their own field. It's narrow. It's pinpointed, and they literally are almost out of it"[17]

People who have frequencies above 900 cps are what Hunt calls mystical personalities. Whereas psychics and trance mediums are often just conduits of information, mystics possess the wisdom to know what to do with the information, says Hunt. They are aware of the cosmic interrelatedness of all things and are in touch with every level of human experience. They are anchored in ordinary reality, but often have both psychic and trance abilities. However, their frequencies also extend way beyond the bands associated with these capabilities. Using a modified electromyogram (an electro myogram can normally detect frequencies only up to 20,000 cps) Hunt has encountered individuals who have frequencies as high as 200,000 cps in their energy fields. This is intriguing, for mystical traditions have often referred to highly spiritual individuals as possessing a "higher vibration" than normal people. If Hunt's findings are correct, they seem to add credence to this assertion.

Another of Hunt's discoveries involves the new science of chaos. As its name implies, chaos is the study of chaotic phenomena, i.e., processes that are so haphazard they do not appear to be governed by any

laws. For example, when smoke rises from an extinguished candle it flows upward in a thin and narrow stream. Eventually the structure of the stream breaks down and becomes turbulent. Turbulent smoke is said to be chaotic because its behavior can no longer be predicted by science. Other examples of chaotic phenomena include water when it crashes at the bottom of a waterfall, the seemingly random electrical fluctuations that rage through the brain of an epileptic during a seizure, and the weather when several different temperature and air-pressure fronts collide.

In the past decade science has discovered that many chaotic phenomena are not as disordered as they seem and often contain hidden patterns and regularities (recall Bohm's assertion that there is no such thing as disorder, only orders of indefinitely high degree). Scientists have also discovered mathematical ways of finding some of the regularities that lie hidden in chaotic phenomena. One of these involves a special kind of mathematical analysis that can convert data about a chaotic phenomenon into a shape on a computer screen. If the data contains no hidden patterns, the resulting shape will be a straight line. But if the chaotic phenomenon does contain hidden regularities, the shape on the computer screen will look something like the spiral designs children make by winding colored yarn around an array of nails pounded into a board. These shapes are called "chaos patterns" or "strange attractors" (because the tines that compose the shape seem to be attracted again and again to certain areas of the computer screen, just as the yarn might be said to be repeatedly "attracted" to the array of nails around which it is wound).

When Hunt observed energy field data on the oscilloscope, she noticed that it changed constantly. Sometimes it came in great clumps, sometimes it waned and became patchy, as if the energy field itself were in an unceasing state of fluctuation. At first glance these changes seemed random, but Hunt sensed intuitively they possessed some order. Realizing that chaos analysis might reveal whether she was right or not, she sought out a mathematician. First they ran four seconds of data from an EKG through the computer to see what would happen. They got a straight line. Then they ran the same amount of data from an EEG and an EMG. The EEG produced a straight line and the EMG produced a slightly swollen line, but still no chaos pattern. Even when they submitted data from the lower frequencies of the human energy field, they got a straight line. But when they analyzed the very high frequencies of the field they met with success. "We got

the most dynamic chaos pattern you ever saw," says Hunt.[1]"

This meant that although the kaleidoscopic changes taking place in the energy field appeared to be random, they were actually very highly ordered and rich with pattern. "The pattern is never a repeatable one, but it's so dynamic and complex, I call it a chaos holograph pattern," Hunt states.[19]

Hunt believes her discovery was the first true chaos pattern to be found in a major eleetrobiological system. Recently researchers have found chaos patterns in EEG recordings of the brain, but they needed many minutes of data from numerous electrodes to obtain such a pattern. Hunt obtained a chaos pattern from three to four seconds of data recorded *by* one electrode, suggesting that the human energy field is far richer in information and possesses a far more complex and dynamic organization than even the electrical activity of the brain.

What Is the Human Energy Field Made Of?

Despite the human energy field's electrical aspects. Hunt does not believe it is purely electromagnetic in nature. "We have a feeling that it is much more complex and without doubt composed of an as yet undiscovered energy," she says.[20]

What is this undiscovered energy? At present we do not know. Our best clue comes from the fact that almost without exception psychics describe it as having a higher frequency or vibration than normal matter-energy. Given the uncanny accuracy talented psychics have in perceiving illnesses in the energy field, we should perhaps pay serious attention to this observation. The universality of this perception— even ancient Hindu literature asserts that the energy body possesses a higher vibration than normai matter—may be an indication that such individuals are intuiting an important fact about the energy field.

Ancient Hindu literature also describes matter as being composed of *anu,* or "atoms," and says that the subtle vibratory energies of the human energy field exist *paramanu,* or literally "beyond the atom." This is interesting, for Bohm also believes that at a subquantum level *beyond the atom* there are many subtle energies still unknown to science. He confesses that he does not know whether the human energy field exists or not, but in commenting on the possibility, he states, "The implicate order has many levels of subtlety. If our attention can

go to those levels of subtlety, then we should be able to see more than we ordinarily see.'"[1]

It is worth noting that we really don't know what *any* field is. As Bohm has said, "What is an electric field? We don't know."[2E] When we discover a new kind of field it seems mysterious. Then we name it, get used to dealing with it and describing its properties, and it no longer seems mysterious. But we still do not know what an electric or a gravitational field really is. As we saw in an earlier chapter, we don't even know what electrons are. We can only describe how they behave. This suggests that the human energy field will also ultimately be defined in terms of how it behaves, and research such as Hunt's will only further our understanding.

Three-Dimensional Images in the Aura

If these inordinately subtle energies are the stuff from which the human energy field is made, we may rest assured that they possess qualities unlike the kinds of energy with which we are normally familiar. One of these is evident in the human energy field's nonlocal characteristics. Another, and one that is particularly holographic, is the aura's ability to manifest as an amorphous blur of energy, or occasionally form itself into three-dimensional images. Talented psychics often report seeing such "holograms" floating in people's auras. These images are usually of objects and ideas that hold a prominent position in the thoughts of the person around whom they are seen. Some occult traditions hold that such images are a product of the third, or mental, layer of the aura, but until we have the means to confirm or deny this allegation, we must confine ourselves to the experiences of the psychics who are able to see images in the aura.

One such psychic is Beatrice Rich. As often happens, Rich's powers manifested at an early age. When she was a child, objects in her presence would occasionally move about on their own accord. When she grew older she discovered she knew things about people she had no normal means of knowing. Although she began her career as an artist, her clairvoyant talents proved so impressive that she decided to become a full-time psychic. Now she gives readings for individuals from all walks of life, from housewives to chief executives of corporations, and articles about her work have appeared in such diverse publi-

cations as *New York* magazine, *World Tennis,* and *New York Woman.*

Rich often sees images floating around or hovering near her clients. Once she saw silver spoons, silver plates, and similar objects circling around a man's head. Because it was early in her explorations of psychic phenomena, the experience startled her. At first she did not know why she was seeing what she was seeing. But finally she told the man and discovered that he was in the import/export business and traded in the very objects she was seeing circling his head. The experience was riveting and changed her perceptions forever.

Dryer has had many similar experiences. Once during a reading she saw a bunch of potatoes whirling around a woman's head. Like Rich, she was at first dumbfounded but summoned her courage and asked the woman if potatoes had any special meaning for her. The woman laughed and handed Dryer her business card. "She was from the Idaho Potato Board, or something like that," says Dryer. "You know, the potato grower's equivalent of the American Dairy Association."[23]

These images don't always just hover in the aura, but sometimes can appear to be ghostly extensions of the body itself- On one occasion Dryer saw a wispy and holographiclike layer of mud clinging to a woman's hands and arms. Given the woman's impeccable grooming and expensive attire, Dryer could not imagine why thoughts of mucking around in some kind of viscous sludge would be occupying her mind. Dryer asked her if she understood the image, and the woman nodded, explaining that she was a sculptor and had tried out a new medium that morning that had clung to her arms and hands exactly as Dryer had described.

I, too, have had similar experiences when looking at the energy field. Once, while deep in thought about a novel I was working on about werewolves (as some readers may be aware, I have a fondness for writing fiction about folkloric subjects), I noticed that the ghostly image of a werewolf's body had formed around my own body. I would quickly like to stress that this was a purely visual phenomenon and at no time did I feel I had in any way become a werewolf. Nonetheless, the holographiclike image that enveloped my body was real enough that when I lifted my arm I could actually see the individual hairs in the fur and the way the canine nails protruded from the wolfish hand that encased my own hand. Indeed, everything about these features was absolutely real, save that they were translucent and I could see my own flesh-and-blood hand beneath them. The experience should

have been frightening, but for some reason it wasn't, and I found myself only fascinated by what I was seeing.

What was significant about this experience was that Dryer was my house guest at the time and happened to walk into the room while I was still sheathed in this phantomlike werewolf body. She reacted immediately and said, "Oh my, you must be thinking about your werewolf novel because you've become a werewolf." We compared notes and discovered that we were each observing the same features. We became involved in conversation, and as my thoughts strayed from the novel, the werewolf image slowly faded.

Movies in the Aura

The images that psychics see in the energy field are not always static. Rich says she often sees what looks like a little transparent movie going on around a client's head: "Sometimes I see a small image of the person behind their head or shoulders doing various things they do in life. My clients tell me that my descriptions are very accurate and specific. I can see their offices and what their bosses look like. I can see what they've thought of and what's happened to them during the last six months. Recently I told a client that I could see her home and she had masks and flutes hanging on her wall. She said, 'No, no, no.' 1 said yes, there are musical instruments hanging on the wall, mostly 0utes, and there are masks. And then she said, 'Oh, that's my summer home.' "[w]

Dryer says she also sees what look like three-dimensional movies in a person's energy field. "Usually they're in color, but they can also be brown, or look like tintypes. Often they depict a story about the person that can take anywhere from five minutes to an hour to unfold. The images are also incredibly detailed. When I see a person sitting in a room I can tell them how many plants are in the room, how many leaves are on each plant, and how many bricks are in the wall. I usually don't get into such minute description unless it seems pertinent."[25]

I can attest to Dryer's accuracy. I have always been an organized person, and when I was a child I was quite precocious in this regard. Once when I was five years old f spent several hours meticulously storing and organizing all of my toys in a closet. When I was finished I showed my mother what I had done and admonished her please not

to touch anything in the closet because I did not want her messing up my carefully ordered arrangements. My mother's account of this incident has amused the family ever since. During my first reading with Dryer she described this incident in detail, as well as many other events in my life, as she watched it unfold like a movie in my energy field. She, too, chuckled as she described it.

Dryer likens the images she sees to holograms and says that when she chooses one and starts to watch it, it seems to expand and fill the entire room. "If I see something going on with a person's shoulder, such as an injury, suddenly the whole scene widens. That's when I get the sense that it's a hologram because sometimes I feel I can step right into it and be a part of it. It's not happening to me, but around me. It's almost as if I'm in a three-dimensional movie, a holographic movie, with the person."[8]*

Dryer's holographic vision is not limited to events from a person's life. She sees visual representations of the operations of the unconscious mind as well. As we all know, the unconscious mind speaks in a language of symbols and metaphors. This is why dreams often seem so nonsensical and mysterious. However, once one learns how to interpret the language of the unconscious, the meanings of dreams beeome clear. Dreams are not the only things that are written in the parlance of the unconscious. Individuals who are familiar with the language of the psyche—a language psychologist Erich Fromm calls the "forgotten language," because most of us have forgotten how to interpret it—recognize its presence in other human creations such as myths, fairy tales, and religious visions.

Some of the holographic movies Dryer sees in the human energy field are also written in this language and resemble the metaphorical messages of dreams. We now know that the unconscious mind is active not only while we dream, but all of the time. Dryer is able to peel back a person's waking self and gaze directly at the unceasing river of images that is always flowing through their unconscious mind. And both practice and her natural, intuitive gifts have made her extremely skilled at deciphering the language of the unconscious. "Jung-ian psychologists love me," says Dryer.

In addition, Dryer has a special way of knowing whether she has interpreted an image correctly. "If I haven't explained it correctly, it doesn't go away," she states. "It just stays in the energy field. But once I've told the person everything they need to know about a particular image, it begins to dissolve and disappear."[27] Dryer thinks this is

because it is a client's own unconscious mind that chooses what images to show her. Like Ullman, she believes the psyche is always trying to teach the conscious self things it needs to know to become healthier and happier, and to grow spiritually.

Dryer's ability to observe and interpret the innermost workings of a person's psyche is one of the reasons she is able to effect such profound transformations in many of her clients. The first time she described the stream of images she saw unfolding in my own energy field, I had the uncanny sensation she was telling me about one of my own dreams, save that it was a dream I had not yet dreamed. At first the phantasmagoria of images was only mysteriously familiar, but as she unraveled and explained each symbol and metaphor in turn, I recognized the machinations of my inner self, both the things I accepted and the things I was less willing to embrace. Indeed, it is clear from the work of psychics like Rich and Dryer that there is an enormous amount of information in the energy field. One wonders if this is perhaps why Hunt obtained such a pronounced chaos pattern when she analyzed data from the aura.

The ability to see images in the human energy field is not new. Nearly three hundred years ago the great Swedish mystic Emanuel Swedenborg reported that he could see a "wave-substance" around people, and in the wave-substance a person's thoughts were visible as images he called "portrayals." In commenting on the inability of other people to see this wave-substance around the body, he observed, "I could see solid concepts of thought as though they were surrounded by a kind of wave. But nothing reaches [normal] human sensation except what is in the middle and seems solid. "[M] Swedenborg could also see portrayals in his own energy field: "When I was thinking about someone I knew, then his image appeared as he looked when he was named in human presence; but all around, like something flowing in waves, was everything I had known and thought about him from boyhood."[23]

Holographic Body Assessment

Frequency is not the only thing that is distributed holographically throughout the field. Psychics report that the wealth of personal information the field contains can also be found in every portion of the

body's aura. As Brennan puts it, "The aura not only represents, but also contains, the whole."[so] California clinical psychologist Ronald Wong Jue agrees. Jue, a former president of the Association for Transpersonal Psychology and a talented clairvoyant, has found that an individual's history is even contained in the "energy patterns" inherent *in* the body, "The body is a kind of microcosm, a universe unto itself reflecting all of the different factors that a person is dealing with and trying to integrate," says Jue.

Like Dryer and Rich, Jue has the psychic ability to tune into movies about the important issues in a person's life, but instead of seeing them in the energy field, he conjures them up in his mind's eye by laying his hands on a person and literally psychometrizing their body. Jue says this technique enables him to determine quickly the emotional scripts, core issues, and relationship patterns that are most prominent in a person's life, and often uses it on his patients to facilitate the therapeutic process. "The technique was actually taught to me by a psychiatrist colleague of mine named Ernest Pecci," Jue states. "He called it 'body reading.' Instead of talking about the etheric body and things like that, I chose to use the holographic model as a way of explaining it and call it Holographic Body Assessment"[31] In addition to using it in his clinical practice, Jue also gives seminars in which he teaches others how to use the technique.

X-Ray Vision

In the last chapter we explored the possibility that the body is not a solid construct, but is itself a kind of holographic image. Another faculty possessed by many clairvoyants seems to support this notion, that is, the ability to literally look inside a person's body. Individuals who are gifted at seeing the energy field can also often adjust their vision and see through the flesh and bones of the body as if they were no more than layers of colored mist.

During the course of her research, Karagulla discovered a number of people, both in and out of the medical profession, who possessed this X-ray vision. One, a woman she identifies as Diane, was the head of a corporation. Just before meeting Diane, Karagulla wrote, "For me as a psychiatrist to be meeting somebody who was reported to be

able to 'see' right through me was a shattering reversal of my usual procedures."[S2]

Karagulla put Diane through a lengthy series of tests, introducing her to people and having her make on-the-spot diagnoses. On one of these occasions Diane described a woman's energy field as "wilted" and "broken into fragments" and said this indicated she had a serious problem in her physical body. She then looked into the woman's body and saw that there was an intestinal blockage near her spleen. This surprised Karagulla because the woman showed none of the symptoms that usually indicated such a serious condition. Nonetheless, the woman went to her doctor, and X rays revealed a blockage in the precise area Diane had described. Three days later the woman underwent surgery to have the life-threatening obstruction removed.

In another series of tests Karagulla had Diane diagnose patients at random in the outpatient clinic of a large New York hospital. After Diane made a diagnosis Karagulla would determine the accuracy of her observations by referring to the patient's records. On one of these occasions Diane looked at a patient unknown to both of them and told Karagulla that the woman's pituitary gland {a gland deep in the brain) was missing, her pancreas looked as if it was not functioning properly, her breasts had been affected but were now missing, she didn't have enough energy going through her spine from the waist down, and she had trouble with her legs. The medical report on the woman revealed that her pituitary gland had been surgically removed, she was taking hormones which affected her pancreas, she had had a double mastectomy due to cancer, an operation on her back to decompress her spinal cord and relieve pains in her legs, and her nerves had been damaged, making it difficult for her to empty her bladder.

In case after case Diane revealed that she could gaze effortlessly into the depths of the physical body. She gave detailed descriptions of the condition of the internal organs. She saw the state of the intestines, the presence or absence of the various glands, and even described the density or brittleness of the bones. Concludes Karagulla, "Although I could not evaluate her findings regarding the energy body, her observations of physical conditions correlated with amazing accuracy with the medical diagnoses.'™

Brennan is also skilled at looking into the human body and calls the ability "internal vision." Using internal vision she has accurately diagnosed a wide range of conditions including bone fractures, fibroid

tumors, and cancer. She says she can often tell the condition of an organ by its color: for example, a healthy liver looks dark red, a jaundiced liver looks a sickly yellow-brown, and the liver of an individual undergoing chemotherapy usually looks green-brown. Like many other psychics with internal vision, Brennan can adjust the focus of her vision and even see microscopic structures, such as viruses and individual blood cells.

I have personally encountered several psychics with internal vision and can corroborate its authenticity. One psychic I have seen demonstrate the ability is Dryer. On one of these occasions she not only accurately diagnosed an internal medical problem I was having, but offered some startling information of an entirety different nature along with it. A few years back I started having trouble with my spleen. To try and remedy the situation, I began performing daily visualization exercises, seeing images of my spleen in a state of wholeness and health, seeing it being bathed in healing light, and so on. Unfortunately, I am a very impatient person, and when I did not have overnight success I got angry. During my next meditation I mentally scolded my spleen and warned it in no uncertain terms that it better start doing what I wanted. This incident took place purely in the privacy of my own thoughts, and I quickly forgot about it

A few days later I saw Dryer and asked her if she could look into my body and tell me if there was anything I should be aware of (I did not tell her about my health problem). Nonetheless, she immediately described what was wrong with my spleen and then paused, scowling as if she was confused. "Your spleen's very upset about something," she murmured. And then suddenly it hit her. "Have you been *yelling* at your spleen?" I sheepishly admitted that I had. Dryer all but threw her hands up. "You mustn't do that. Your spleen became ill because it thought it was doing what you wanted. That was because you were unconsciously giving it the wrong directions. Now that you've yelled at it, it's really confused." She shook her head with concern. "Never, never get angry at your body or your internal organs," she advised. "Only send them positive messages."

The incident not only revealed Dryer's skill at looking inside the human body, but also seemed to suggest that my spleen has some sort of mentality or consciousness all of its own. It reminded me not only of Pert's assertion that she no longer knows where the brain leaves off and the body begins, but made me wonder if perhaps all of the body's subcomponents—glands, bones, organs, and cells—possess

their own intelligence? If the body is truly holographic, it may be that Pert's remark is more correct than we realize, and the consciousness of the whole is very much contained in all of its parts.

Internal Vision and Shamanism

In some shamanic cultures internal vision is one of the prerequisites for becoming a shaman. Among the Araucanian Indians of Chile and the Argentine pampas, a newly initiated shaman is taught to pray specifically for the faculty. This is because the shaman's major role in Araucanian culture is to diagnose and heal illness, for which internal vision is considered essential.'" Australian shamans refer to the ability as the "strong eye," or "seeing with the heart."[31] The Jivaro Indians of the forested eastern slopes of the Ecuadorian Andes acquire the ability by drinking an extract of a jungle vine called *ayahuasca,* a plant containing a hallucinogenic substance believed to bestow psychic abilities on the imbiber. According to Michael Harner, an anthropologist at the New School for Social Research in New York who specializes in shamanic studies, *ayakuasca* permits the Jivaro shaman "to see into the body of the patient as though it were glass."[3B]

Indeed, the ability to "see" an illness—whether it involves actually looking inside the body or seeing the malady represented as a kind of metaphorical hologram, such as a three-dimensional image of a demonic and repulsive creature inside or near the body—is universal in shamanic traditions. But whatever the culture in which internal vision is reported, its implications are the same. The body is an energy construct and ultimately may be no more substantive than the energy field in which it is embedded.

The Energy Field as Cosmic Blueprint

The idea that the physical body is just one more level of density in the human energy field and is itself a kind of hologram that has coalesced out of the interference patterns of the aura may explain both the extraordinary healing powers of the mind and the enormous control it has over the body in general. Because an illness can appear in the

energy field weeks and even months before it appears in the body, many psychics believe that disease actually originates in the energy field. This suggests that the field is in some way more primary than the physical body and functions as a kind of blueprint from which the body gets its structural cues. Put another way, the energy field may be the body's own version of an implicate order.

This may explain Achterberg's and Siegel's findings that patients are already "imaging" their illnesses many months before the illnesses manifest in their bodies. At present, medical science is at a loss to explain how mental imagery could actually create an illness. But, as we have seen, ideas that are prominent in our thoughts quickly appear as images in the energy field. If the energy field is the blueprint that guides and molds the body, it may be that by imaging an illness, even unconsciously, and repeatedly reinforcing its presence in the field, we are in effect programming the body to manifest the illness.

Similarly, this same dynamic linkage between mental images, the energy field, and the physical body may be one of the reasons imagery and visualization can also heal the body. It may even help explain how faith and meditation on religious images enable stigmatists to grow nail-like fleshy protuberances from their hands. Our current scientific understanding is at a loss to explain such a biological capacity, but again, constant prayer and meditation may cause such images to become so impressed in the energy field that the constant repetition of these patterns is finally given form in the body.

One researcher who believes it is the energy field that molds the body and not the other way around is Richard Gerber, a Detroit physician who has spent the last twelve years investigating the medical implications of the body's subtle energy fields. "The etheric body is a holographic energy template that guides the growth and development of the physical body," says Gerber.[37]

Gerber believes that the distinct layers some psychics see in the aura also play a factor in the dynamic relationship among thought, the energy field, and the physical body. Just as the physical body is subordinate to the etheric, the etheric body is subordinate to the astral/emotional body, the astral/emotional to the mental, and so on, says Gerber, with each body functioning as the template for the one before it. Thus the subtler the layer of the energy field in which an image or thought manifests, the greater its ability to heal and reshape the body. "Because the mental body feeds energy into the astral/emotional

body, which then funnels down into the etheric and physical bodies, healing a person at the mental level is stronger and produces longer lasting results than healing from either the astral or etheric levels," says Gerber.[31]*

Physicist Tiller agrees. "The thoughts that one creates generate patterns at the mind level of nature. So we see that illness, in fact, eventually becomes manifest from the altered mind patterns through the rachet effect—first, to effects at the etheric level and then, ultimately, at the physical level [where] we see it openly as disease." Tiller believes the reason illnesses often recur is that medicine currently treats only the physical level. He feels that if doctors could treat tbe energy field as well, they would bring about longer lasting cures. Until then, many treatments "will not be permanent because we have not altered the basic hologram at the mind and spiritual levels," he states.[33]

In a wide-ranging speculation Tiller even suggests that the universe itself started as a subtle energy field and gradually became dense and material through a similar rachet effect. As he sees it, it may be that God created the universe as a divine pattern or idea. Like the image a psychic sees floating in the human energy field, this divine pattern functioned as a template, influencing and molding increasingly less subtle levels of the cosmic energy field "on down the line via a series of holograms," until it eventually coalesced into a hologram of a physical universe.[40]

If this is true, it suggests that the human body is holographic in another way, for each of us truly would be a universe in miniature. Furthermore, if our thoughts can cause ghostly holographic images to form, not only in our own energy fields, but in the subtle energetic levels of reality itself, it may help explain how the human mind is able to effect some of the miracles we examined in the previous chapter. It may even explain synchronicities, or how processes and images from the innermost depths of our psyche manage to take form in external reality. Again, it may be that our thoughts are constantly affecting the subtle energetic levels of the holographic universe, but only emotionally powerful thoughts, such as the ones that accompany moments of crisis and transformation—the kind of events that seem to engender Synchronicities—are potent enough to manifest as a series of coincidences in physical reality.

A Participatory Reality

Of course, these processes are not contingent on the subtle energy fields of the universe being stratified into rigidly defined layers. They could also work even if the subtle fields of the universe are a smooth continuum. In fact, given how sensitive these subtle fields are to our thoughts, we must be very careful when trying to form set ideas about their organization and structure. What we believe about them may in fact help mold and create their structure.

This is perhaps why psychics disagree about whether the human energy field is divided into layers. Psychics who believe in dearly defined layers may actually be causing the energy field to form itself into layers. The individual whose energy field is being observed may also participate in this process. Brennan is very frank about this and notes that the more one of her clients understands the difference between the layers, the clearer and more distinct the layers of their energy field become. She admits that the structure she sees in the energy field is thus but one system, and others have come up with other systems. For example, the authors of the tantras, a collection of Hindu yogic texts written during the fourth through sixth centuries A.D., perceived only three layers in the energy field.

There is evidence that the structures clairvoyants inadvertently create in the energy field can be remarkably long-lived. For centuries the ancient Hindus believed that each chakra also had a Sanskrit letter written in its center. Japanese researcher Hiroshi Motoyama, a clinical psychologist who has successfully developed a technique for measuring the electrical presence of the chakras, says that he first became interested in the chakras because his mother, a simple woman with natural clairvoyant gifts, could see them clearly. However, for years she was puzzled because she could see what looked like an inverted sailboat in her heart chakra. It wasn't until Motoyama began his own investigations that he discovered what his mother was seeing was the Sanskrit letter *yam,* the letter the ancient Hindus perceived in the heart chakra."[11] Some psychics, such as Dryer, say that they also see Sanskrit letters in the chakras. Others do not. The only explanation appears to be that psychics who see the letters are actually tuning into holographic structures long ago imposed on the energy field by the beliefs of the ancient Hindus.

At first glance this notion may seem strange, but it does have a

precedent. As we have seen, one of the basic tenets of quantum physics is that we are not discovering reality, but participating in its creation. It may be that as we probe deeper into the levels of reality beyond the atom, the levels where the subtle energies of the human aura appear to lie, the participatory nature of reality becomes even more pronounced. Thus we must be extremely cautious about saying that we have discovered a particular structure or pattern in the human energy field, when we may have actually created what we have found.

Mind and the Human Energy Field

It is significant that an examination of the human energy field leads one to precisely the same conclusion Pribram made after discovering that the brain converts sensory import into a language of frequencies. That is, that we have two realities: one in which our bodies appear to be concrete and possess a precise location in space and time; and one in which our very being appears to exist primarily as a shimmering cloud of energy whose ultimate location in space is somewhat ambiguous. This realization brings with it some profound questions. One is, what becomes of mind? We have been taught that our mind is a product of our brain, but if the brain and the physical body are just holograms, the densest part of an increasingly subtle continuum of energy fields, what does this say about the mind? Human energy field research provides an answer.

Recently a discovery made by neurophysiologists Benjamin Libet and Bertram Feinstein at Mount Zion Hospital in San Francisco has been causing a stir in the scientific community. Libet and Feinstein measured the time it took for a touch stimulus on a patient's skin to reach the brain as an electrical signal. The patient was also asked to push a button when he or she became aware of being touched. Libet and Feinstein found that the brain registered the stimulus in 0.0001 of a second after it occurred, and the patient pressed the button 0.1 of a second after the stimulus was applied.

But, remarkably, the patient didn't report being consciously aware of either the stimulus or pressing the button *for almost 0.5 second.* This meant that the decision to respond was being made by the patient's unconscious mind. The patient's awareness of the action was the slow man in the race. Even more disturbing, none of the patients

Libet and Feinstein tested were aware that their unconscious minds had already caused them to push the button before they had consciously decided to do so. Somehow their brains were creating the comforting delusion that they had consciously controlled the action even though they had not.[4]- This has caused some researchers to wonder if free will is an illusion. Later studies have shown that one and a half seconds before we "decide" to move one of our muscles, such as lift a finger, our brain has already started to generate the signals necessary to accomplish the movement.[43] Again, who is making the decision, the conscious mind or the unconscious mind?

Hunt does such findings one better. She has discovered that the human energy field responds to stimuli even before the brain does. She has taken EMG readings of the energy field and EEG readings of the brain simultaneously and discovered that when she makes a loud sound or flashes a bright light, the EMG of the energy field registers the stimulus before it ever shows up on the EEG. What does it mean? "I think we have way overrated the brain as the active ingredient in the relationship of a human to the world," says Hunt. "It's just a real good computer. But the aspects of the mind that have to do with creativity, imagination, spirituality, and all those things, I don't see them in the brain at all. The mind's not in the brain. It's in that dam field."[44]

Dryer has also noticed that the energy field responds before a person consciously registers a response. As a consequence, instead of trying to judge her client's reactions by watching their facial expressions, she keeps her eyes closed and watches how their energy fields react. "As I speak I can see the colors change in their energy field. I can see how they feel about what I'm saying without having to ask them. For instance, if their field becomes foggy I know they're not understanding what I'm telling them," she states.[155]

If the mind is not in the brain, but in the energy field that permeates both the brain and the physical body, this may explain why psychics such as Dryer see so much of the content of a person's psyche in the field. It may also explain how my spleen, an organ not normally associated with thought, managed to have its own rudimentary form of intelligence. Indeed, if the mind is in the field, it suggests that our awareness, the thinking, feeling part of ourselves, may not even be confined to the physical body, and as we will see, there is considerable evidence to support this idea as well.

But first we must turn our attention to another issue. The solidity

of the body is not the only thing that is illusory in a holographic universe. As we have seen, Bohm believes that even time itself is not absolute, but unfolds out of the implicate order. This suggests that the linear division of time into past, present, and future is also just another construct of the mind. In the next chapter we will examine the evidence that supports this idea as well as the ramifications this view has for our lives in the here and now.

PART II!

SPACE AND TIME

Shamanism and similar mysterious areas of research have gained in significance because they postulate new ideas about mind and spirit. They speak of things like vastly expanding the realm of consciousness . . . the belief, the knowledge, and even the experience that our physical world of the senses is a mere illusion, a world of shadows, and that the three-dimensional tool we call our body serves only as a container or dwelling place for Something infinitely greater and more comprehensive than that body and which constitutes the matrix of the real life.

—Holger Kahveit Oreamtime
and fnner Space

7

Time Out of Mind

> The "home" of the mind, as of all things, is the implicate order. At this level, which is the fundamental plenum for the entire manifest universe, there is no linear time. The implicate domain is atemporal; moments are not strung together serially like beads on a string.
>
> ■—Larry Dossey
> *Recovering the Soul*

As the man gazed off into space, the room he was in became ghostly and transparent, and in its place materialized a scene from the distant past. Suddenly he was in the courtyard of a palace, and before him was a young woman, olive-skinned and very pretty. He could see her gold jewelry around her neck, wrists, and ankles, her white translucent dress, and her black braided hair gathered regally under a high square-shaped tiara. As he looked at her, information about her life flooded his mind. He knew she was Egyptian, the daughter of a prince, but not a pharaoh. She was married. Her husband was slender and wore his hair in a multitude of small braids that fell down on both sides of his face.

The man could also fast-forward the scene, rushing through the events of the woman's life as if they were no more than a movie. He saw that she died in childbirth. He watched the lengthy and intricate steps of her embalming, her funeral procession, the rituals that accom-

panied her being placed in her sarcophagus, and when he finished, the images faded and the room once again came back into view.

The man's name was Stefan Ossowiecki, a Russtan-bom Pole and one of the century's most gifted clairvoyants, and the date was February 14,19S5. His vision of the past had been evoked when he handled a fragment of a petrified human foot

Ossowiecki proved so adept at psychometrizing artifacts that he eventually came to the attention of Stanislaw Poniatowski, a professor at the University of Warsaw and the most eminent ethnologist in Poland at the time. Poniatowski tested Ossowiecki with a variety of flints and other stone tools obtained from archaeological sites around the world. Most of these *Hthics,* as they are called, were so nondescript that only a trained eye could tell they had been shaped by human hands. They were also precertified by experts so that Poniatowski knew their ages and historical origins, information he kept carefully concealed from Ossowiecki.

It did not matter. Again and again Ossowiecki identified the objects correctly, describing their age, the culture that had produced them, and the geographical locations where they had been found. On several occasions the locations Ossowiecki cited disagreed with the information Poniatowski had written in his notes, but Poniatowski discovered that it was always his notes that were in error, not Ossowiecki's information.

Ossowiecki always worked the same. He would take the object in his hands and concentrate until the room before him, and even his own body, became shadowy and almost nonexistent After this transition occurred, he would find himself looking at a three-dimensional movie of the past He could then go anywhere he wanted in the scene and see anything he chose. While he was gazing into the past, Ossowiecki even moved his eyes back and forth as if the things he was describing possessed an actual physical presence before him.

He could see the vegetation, the people, and the dwellings in which they lived. On one occasion, after handling a stone implement from the Magdalenian culture, a Stone Age people who flourished in France about 15,000 to 10,000 B.C, Ossowiecki told Poniatowski that Magdalenian women had very complex hair styles. At the time this seemed absurd, but subsequent discoveries of statues of Magdalenian women with ornate coiffures proved Ossowiecki right

Over the course of the experiments Ossowiecki offered over one hundred such pieces of information, details about the past that at first

seemed inaccurate, but later proved correct He said that Stone Age peoples used oil lamps and was vindicated when excavations in Dor-dogne, France, uncovered oils lamps of the exact size and style he described. He made detailed drawings of the animals various peoples hunted, the style of the huts in which they lived, and their burial customs—assertions that were all later confirmed by archaeological discoveries.[1]

Poniatowski's work with Ossowiecki is not unique. Norman Emerson, a professor of anthropology at the University of Toronto and founding vice president of the Canadian Archaeological Association, has also investigated the use of clairvoyants in archaeological work. Emerson's research has centered around a truck driver named George McMullen. Like Ossowiecki, McMullen has the ability to psychometrize objects and use them to tune into scenes from the past McMullen can also tune into the past simply by visiting an archaeological site. Once there, he paces back and forth until he gets his bearings. Then he begins to describe the people and culture that once flourished at the site. On one such occasion Emerson watched as McMullen bounded over a pateh of bare ground, pacing out what he said was the location of an Iroquois longhouse. Emerson marked the area with survey pegs and six months later uncovered the ancient structure exactly where McMullen said it would be.[3]

Although Emerson began as a skeptic, his work with McMullen has made him a believer. In 1973, at an annual conference of Canada's leading archaeologists, he stated, "It is my conviction that I have received knowledge about archaeological artifacts and archaeological sites from a psychic informant who relates this information to me without any evidence of the conscious use of reasoning." He concluded his talk by saying that he felt McMullen's demonstrations opened "a whole new vista" in archaeology, and research into the further use of psychics in archaeological investigations should be given "first priority."[3]

Indeed, *retrocognition,* or the ability of certain individuals to shift the focus of their attention and literally gaze back into the past, has been confirmed repeatedly by researchers. In a series of experiments conducted in the 1960s, W. H. C. Tenhaeff, the director of the Parapsy-chological Institute of the State University of Utrecht, and Marius Valkhoff, dean of the faculty of arts at the University of Witwaters-rand, Johannesburg, South Africa, found that the great Dutch psychic, Gerard Croiset, could psychometrize even the smallest fragment

of bone and accurately describe its past.[4] Dr. Lawrence LeShan, a New York clinical psychologist, and another skeptic-turned-believer, has conducted similar experiments with the noted American psychic, Eileen Garrett.[0] At the 1961 annua) meeting of the American Anthropological Association, archaeologist Clarence W. Weiant revealed that he would not have made his famous Tres Zapotes discovery, universally considered to be one of the most important Middle American archaeological finds ever made, were it not for the assistance of a psychic.[6]

Stephan A. Schwartz, a former editorial staff member of *National Geographic* magazine and a member of MITs Secretary of Defense Discussion Group on Innovation, Technology, and Society, believes that retrocognition is not only real, but will eventually precipitate a shift in scientific reality as profound as the shifts that followed the discoveries of Copernicus and Darwin. Schwartz feels so strongly about the subject that he has written a comprehensive history of the partnership between clairvoyants and archaeologists entitled *The Secret Vaults of Time*. "For three-quarters of a century psychic archaeology has been a reality," says Schwartz. "This new approach has done much to demonstrate that the time and space framework so crucial to the Grand Material world-view is by no means as absolute a construct as most scientists believe."[7]

The Past as Hologram

Such abilities suggest that the past is not lost, but still exists in some form accessible to human perception. Our normal view of the universe makes no allowance for such a state of affairs, but the holographic model does. Bohm's notion that the flow of time is the product of a constant series of unfoldings and enfoldings suggests that as the present enfolds and becomes part of the past, it does not cease to exist, but simply returns to the cosmic storehouse of the implicate. Or as Bohm puts it, "The past is active in the present as a kind of implicate order."[8]

If, as Bohm suggests, consciousness also has its source in the implicate, this means that the human mind and the holographic record of the past already exist in the same domain, are, in a manner of speaking, already neighbors. Thus, a shift in the focus of one's attention

may be all that is needed to access the past. Clairvoyants such as McMulIen and Ossowiecki may simply be individuals who have an innate knack for making this shift, but again, as with so many of the other extraordinary human abilities we have looked at, the holographic idea suggests that the talent is latent in all of us.

A metaphor for the way the past is stored in the implicate can also be found in the hologram. If each phase of an activity, say a woman blowing a soap bubble, is recorded as a series of successive images in a multiple-image hologram, each image becomes as a frame in a movie. If the hologram is a "white light" hologram—a piece of holographic film whose image can be seen by the naked eye and does not need laser light to become visible—when a viewer walks by the film and changes the angle of his or her perception, he/she will see what amounts to a three-dimensional motion picture of the woman blowing the soap bubble. In other words, as the different images unfold and enfold, they will seem to flow together and present an illusion of movement.

A person who is unfamiliar with holograms might mistakenly assume that the various stages in the blowing of the soap bubble are transitory and once perceived can never be viewed again, but this is not true. The entire activity is always recorded in the hologram, and it is the viewer's changing perspective that provides the illusion that it is unfolding in time. The holographic theory suggests that the same *4* is true of our own past. Instead of fading into oblivion, it too remains recorded in the cosmic hologram and can always be accessed once again.

Another suggestively hologramlike feature of the retrocognitive experience is the three-dimensionality of the scenes that are accessed. For instance, psychic Rich, who can also psychometrize objects, says she knows what Ossowiecki meant when he said that the images he saw were as three-dimensional and real, even more real, than the room in which he was sitting. "It's as if the scene takes over," says Rich. "It's dominant, and once it starts to unfold I actually become a part of it. It's like being in two places at once. I'm aware that I'm sitting in a room, but I'm also in the scene."[8]

Similarly holographic is the nonlocal nature of the ability. Psychics are able to access the past of a particular archaeological site both when they are at the site and when they are many miles removed. In other words, the record of the past does not appear to be stored at any one location, but like the information in a hologram, it is nonlocal and can be accessed from any point in the space-time framework. The

cal ruins—burial mounds, standing stones, crumbling sixth-century fortresses, and so on—and participated in activities associated with bygone times. Evans-Wentz interviewed witnesses who had seen fairies that looked like men in Elizabethan dress engaging in hunts, fairies that walked in ghostly processions to and from the remains of old forts, and fairies that rang bells while standing in the ruins of ancient churches. One activity of which the fairies seemed inordinately fond was waging war. In his book *The Fairy-Faitk in Celtic Countries* Evans-Wentz presents the testimony of dozens of individuals who claimed to see these spectral conflicts, moonlit meadows thronged with men battling in medieval armor, or desolate fens covered with soldiers in colored uniforms. Sometimes these frays were eerily silent. Sometimes they were full-fledged dins; and, perhaps most haunting of all, sometimes they could only be heard but not seen.

From this, Evans-Wentz concluded that at least some of the phenomena his witnesses were interpreting as fairies were actually some kind of afterimage of events that had taken place in the past. "Nature herself has a memory," he theorized. "There is some indefinable psychic element in the earth's atmosphere upon which all human and physical actions or phenomena are photographed or impressed. Under certain inexplicable conditions, normal persons who are not seers may observe Nature's mental records like pictures cast upon a screen— often like moving pictures."[14]

As for why encounters with fairies were becoming less frequent, a remark made by one of Evans-Wentz's respondents provides a clue. The respondent was an elderly gentleman named John Davies living on the Isle of Man, and after describing numerous sightings of the good people, he stated, "Before education came into the island more people could see the fairies; now very few people can see them."'[5] Since "education" no doubt included an anathema against believing in fairies, Davies's remark suggests that it was a change in attitude that caused the widespread retrocognitive abilities of the Manx people to atrophy. Once again this underscores the enormous power our beliefs have in determining which of our extraordinary potentials we manifest and which we do not

But whether our beliefs allow us to see these hologramlike movies of the past or cause our brains to edit them out, the evidence suggests that they exist nonetheless. Nor are such experiences limited to Celtic countries. There are reports of witnesses seeing phantom soldiers dressed in ancient Hindu costumes in India.[16] In Hawaii, such ghostly

displays are well known and books on the islands are filled with accounts of individuals who have seen phantom processions of Hawaiian warriors in feather cloaks marching along with war clubs and torches.[17] Sightings of spectral armies fighting equally phantasmal battles are even mentioned in ancient Assyrian texts.[18]

Occasionally historians are able to recognize the event being replayed. At four in the morning on August 4,1951, two English women vacationing in the seaside village of Puys, France, were awakened by the sound of gunfire. They raced to the window but were shocked to find that the village and the sea beyond were calm and devoid of any activity that might account for what they were hearing. The British Society for Psychical Research investigated and discovered that the women's chronology of events mirrored exactly military records of a raid the Allies had made against the Germans at Puys on August 19, 1942. The women, it seemed, had heard the sound of a slaughter that had taken place nine years earlier.[19]

Although the dark intensity of such events gives them a higher profile in the holographic landscape, we must not forget that contained within the shimmering holographic record of the past are all the joys of the human race as well. It is, in essence, a library of all that ever was, and learning to tap into this dazzling and infinite treasure-trove on a more massive and systematic scale could expand our knowledge of both ourselves and the universe in ways we have not yet dared dream. The day may come when we can manipulate reality like the crystal in Bohm's analogy, causing what is real and what is invisible to shift kaleidoscopic ally and calling up images of the past with the same ease that we now call up a program on our computer. But even this is not all that a more holographic understanding of time may offer.

The Holographic Future

As disconcerting as having access to the entire past is, it pales beside the notion that the future is also accessible in the cosmic hologram. Still, there is an enormous body of evidence that proves at least some future events are as easy to see as past events.

This has been amply demonstrated in literally hundreds of studies. In the 1930s J. B. and Louisa Rhine discovered that volunteers could guess what cards would be drawn randomly from a deck with a sue-

cess rate that was better than chance by odds of three million to one.[20] In the 1970s Helmut Schmidt, a physicist at Boeing Aircraft in Seattle, Washington, invented a device that enabled him to test whether people could predict random subatomic events. In repeated tests with three volunteers and over sixty thousand trials, he obtained results that were one billion to one against chance.[21]

In his work at the Dream Laboratory at Maimonides Medical Center, Montague Uliman, along with psychologist Stanley Krippner and researcher Charles Honorton, produced compelling evidence that accurate precognitive information can also be obtained in dreams. In their study, volunteers were asked to spend eight consecutive nights at the sleep laboratory, and each night they were asked to try to dream about a picture that would be chosen at random the next day and shown to them. Uliman and his colleagues hoped to get one success out of eight, but found that some subjects could score as many as five "hits" out of eight.

For example, after waking, one volunteer said that he had dreamed of "a large concrete building" from which a "patient" was trying to escape. The patient had a white coat on like a doctor's coat and had gotten only "as far as the archway." The painting chosen at random the next day turned out to be Van Gogh's *Hospital Corridor at SL Remy,* a watercolor depicting a lone patient standing at the end of a bleak and massive hallway and quickly exiting through a door beneath an archway.[22]

In their remote-viewing experiments at Stanford Research Institute, Puthoff and Targ found that, in addition to being able to psychically describe remote locations that experimenters were visiting in the present, test subjects could also describe locations experimenters would be visiting in the future, *before* the locations had even been decided upon. In one instance, for example, an unusually talented subject named Hella Hammid, a photographer by vocation, was asked to describe the spot Puthoff would be visiting one-half hour hence. She concentrated and said she could see him entering "a black iron triangle." The triangle was "bigger than a man/' and although she did not know precisely what it was, she could hear a rhythmic squeaking sound occurring "about once a second."

Ten minutes before she did this, Puthoff had set out on a half-hour drive in the Menlo Park and Palo Alto areas. At the end of the half hour, and well after Hammid had recorded her perception of the black iron triangle, Puthoff took out ten sealed envelopes containing ten

different target locations. Using a random number generator, he chose one at random. Inside was the address of a small park about six miles from the laboratory. He drove to the park, and when he got there he found a children's swing—the black iron triangle—and walked into its midst. When he sat down in the swing it squeaked rhythmically as it swung back and forth.[23]

Puthoff and Targ's precognitive remote-viewing findings have been duplicated by numerous laboratories around the world, including Jahn and Dunne's research facility at Princeton. Indeed, in 334 formal trials Jahn and Dunne found that volunteers were able to come up with accurate precognitive information 62 percent of the time.[24]

Even more dramatic are the results of the so-called "chair tests," a famous series of experiments devised by Croiset. First, the experimenter would randomly select a chair from the seating plan for an upcoming public event in a large hall or auditorium. The hall could be located in any city in the world and only events that did not have reserved seating qualified. Then, without telling Croiset the name or location of the hall, or the nature of the event, the experimenter would ask the Dutch psychic to describe who would be sitting in the seat during the evening in question.

Over the course of a twenty-five-year period, numerous investigators in both Europe and America put Croiset through the rigors of the chair test and found that he was almost always capable of giving an accurate and detailed description of the person who would be sitting in the chair, including describing their gender, facial features, dress, occupation, and even incidents from their past.

For instance, on January 6, 1969, in a study conducted by Dr. Jule Eisenbud, a clinical professor of psychiatry at the University of Colorado Medical School, Croiset was told that a chair had been ehosen for an event that would take place on January 23,1969. Croiset, who was in Utrecht, Holland, at the time, told Eisenbud that the person who would sit in the chair would be a man five feet nine inches in height who brushed his black hair straight back, had a gold tooth in his lower jaw, a scar on his big toe, who worked in both science and industry, and sometimes got his lab coat stained by a greenish chemical. On January 23,1969, the man who sat down in the chair, which was in an auditorium in Denver, Colorado, fit Croiset's description in every way but one. He was not five feet nine, but five feet nine and three-quarters.[25]

The list goes on and on.

almost universally stress how important dreaming is in divining the future. Even our most ancient writings pay homage to the premonitory power of dreams, as is evidenced in the biblical account of Pharaoh's dream of seven fat and seven lean cows. The antiquity of such traditions indicates that the tendency of premonitions to occur in dreams is due to more than just our current skeptical attitude toward precognition. The proximity the unconscious mind has to the atem-poral realm of the implicate may also play a role. Because our dreaming self is deeper in the psyche than our conscious self—and thus closer to the primal ocean in which past, present, and future become one—it may be easier for it to access information about the future.

Whatever the reason, it should come as no surprise that other methods for accessing the unconscious can also produce precognitive information. For example, in the 1960s Karlis Osis and hypnotist J. Fahler found that hypnotized subjects scored significantly higher on precognition tests than nonhypnotized subjects.[38] Other studies have also confirmed the ESP-enhancing effects of hypnosis.[37] However, no amount of dry statistical data has the impact of an example from real life. In his book *The Future Is Now: The Significance of Precognition,* Arthur Osborn records the results of a hypnosis-precognition experiment involving the French actress Irene Muza. After being hypnotized and asked if she could see her future, Muza replied, "*My* career will be short: I dare not say what my end will be: it will be terrible."

Startled, the experimenters decided not to tell Muza what she had reported and gave her a posthypnotic suggestion to forget everything she had said. When she awakened from her trance she had no memory of what she had predicted for herself. Even if she had known, it would not have caused the type of death she suffered. A few months later her hairdresser accidentally spilled some mineral spirits on a lighted stove, causing Muza's hair and clothing to be set on fire. Within seconds she was engulfed in flames and died in a hospital a few hours later.[38]

Hololeaps of Faith

The events that befell Irene Muza raise an important question. If Muza had known about the fate she had predicted for herself, would

she have been able to avoid it? Put another way, is the future frozen and completely predetermined, or can it be changed? At first blush, the existence of precognitive phenomena seems to indicate that the former jg the case, but this would be a very disturbing state of affairs. If the future is a hologram whose every detail is already fixed, it means that we have no free will. We are all just puppets of destiny moving mind-lessly through a script that has already been written.

Fortunately the evidence overwhelmingly indicates that this is not the case. The literature is filled with examples of people who were able to use their precognitive glimpses of the future to avoid disasters, instances in which individuals correctly foresaw the crash of a plane and avoided death by not getting on, or had a vision of their children being drowned in a flood and moved them out of harm's way just in the nick of time. There are nineteen documented cases of people who had precognitive glimpses of the sinking of the *Titanic*—some were experienced by passengers who paid attention to their premonitions and survived, some were experienced by passengers who ignored their forebodings and drowned, and some were experienced by individuals who were not in either of these two categories.[39]

Such incidents strongly suggest that the future is not set, but is plastic and can be changed. But this view also brings with it a problem. If the future is still in a state of flux, what is Croiset tapping into when he describes the individual who will sit down in a particular chair seventeen days hence? How can the future both exist and not exist?

Loye provides a possible answer. He believes that reality *is* a giant hologram, and in it the past, present, and future are indeed fixed, at least up to a point The rub is that it is not the only hologram. There are many such holographic entities floating in the timeless and spaceless waters of the implicate, jostling and swimming around one another like so many amoebas. "Such holographic entities could also be visualized as parallel worlds, parallel universes," says Loye.

Thus, the future of any given holographic universe *is* predetermined, and when a person has a precognitive glimpse of the future, they are tuning into the future of that particular hologram only. But like amoebas, these holograms also occasionally swallow and engulf each other, melding and bifurcating like the protoplasmic globs of energy that they really are. Sometimes these jostlings jolt us and are responsible for the premonitions that from time to time engulf us. And when we act upon a premonition and appear to alter the future, what We are really doing is leaping from one hologram to another. Loye

calls these *intra* holographic leaps "hololeaps" and feels that they are what provides us with our true capacity for both insight and freedom.[40]

Bohm sums up the same situation in a slightly different manner. "When people dream of accidents correctly and do not take the plane or ship, it is not the actual future that they were seeing. It was merely something in the present which is implicate and moving toward making that future. In fact, the future they saw differed from the actual future because they altered it. Therefore I think it's more plausible to say that, if these phenomena exist, there's an anticipation of the future in the implicate order in the present. As they used to say, coming events cast their shadows in the present Their shadows are being cast deep in the implicate order.""[1]

Bohm's and Loye's descriptions seem to be two different ways of trying to express the same thing—a view of the future as a hologram that is substantive enough for us to perceive it, but malleable enough to be susceptible to change. Others have used still different words to sum up what appears to be the same basic thought. Cordero describes the future as a hurricane that is beginning to form and gather momentum, becoming more concrete and unavoidable as it approaches.[42] Ingo Swann, a gifted psychic who has produced impressive results in various studies, including Puthoff and Targ's remote-vie wing research, speaks of the future as composed of "crystallizing possibilities."" The Hawaiian kahunas, widely esteemed for their precognitive powers, also speak of the future as fluid, but in the process of "crystallizing," and believe that great world events are crystallized furthest in advance, as are the most important events in a person's life, such as marriage, accidents, and death.[44]

The numerous premonitions that are now known to have preceded both the Kennedy assassination and the Civil War (even George Washington had a precognitive vision of a future civil war somehow involving "Africa," the issue that all men are "brethren," and the word *Union*[4]'')

seem to corroborate this kahuna belief.

Loye's notion that there are many separate holographic futures and we choose which events are going to manifest and which are not by leaping from one hologram to another carries with it another implication. Choosing one holographic future over another is essentially the same as creating the future. As we have seen, there is a good deal of evidence suggesting that consciousness plays a significant role in creating the here and now. But if the mind can stray beyond the

poundaries of the present and occasionally stalk the misty landscape of the future, do we have a hand in creating future events as well? Put another way, are the vagaries of life truly random, or do we play a role in literally sculpting our own destiny? Remarkably, there is some intriguing evidence that the latter may be the case.

The Shadowy Stuff of the Soul

Dr. Joel Whitton, a professor of psychiatry at the University of Toronto Medical School, has also used hypnosis to study what people unconsciously know about themselves. However, instead of asking them about their future, Whitton, who is an expert in clinical hypnosis and also holds a degree in neurobiology, asks them about their past, their distant past to be exact. For the last several decades Whitton has quietly and without fanfare been gathering evidence suggestive of reincarnation.

Reincarnation is a difficult subject, for so much silliness has been presented about it that many people dismiss it out of hand. Most do not realize that in addition to (and one might even say in spite of) the sensational claims of celebrities and the stories of reincarnated Cleopatras that garner most of the media attention, there is a good deal of serious research being done on reincarnation. In the last several decades a small but growing number of highly credentialed researchers has compiled an impressive body of evidence on the subject Whitton is one of these researchers.

The evidence does not prove that reincarnation exists, nor is it the intention of this book to make such an argument. In fact, it is difficult to imagine what might constitute perfect proof of reincarnation. Rather, the findings that will be touched upon here are offered only as intriguing possibilities and because they are relevant to our current discussion. Thus, they deserve our open-minded consideration.

The main thrust of Whitton's hypnosis research is based on a simple and startling fact. When individuals are hypnotized, they often remember what appear to be memories of previous existences. Studies nave shown that over 90 percent of all hypnotizable individuals are able to recall these apparent memories.[46] The phenomenon is widely ^cognized, even by skeptics. For example, the psychiatry textbook *Trauma, Trance and Transformation* warns fledgling hypnothera-

pists not to be surprised if such memories surface spontaneously in their hypnotized patients. The author of the text rejects the idea of rebirth but does note that such memories can have remarkable healing potential nonetheless."[7]

The meaning of this phenomenon is, of course, hotly debated. Many researchers argue that such memories are fantasies or fabrications of the unconscious mind, and there is no doubt that this is sometimes the case, especially if the hypnotic session or "regression" is conducted by an unskilled hypnotist who does not know the proper questioning techniques required to safeguard against eliciting fantasies. But there are also numerous cases on record in which individuals have, under the guidance of skilled professionals, produced memories that do not appear to be fantasies. The evidence assembled by Whitton falls into this category.

To conduct his research, Whitton gathered together a core group of roughly thirty people. These included individuals from all walks of life, from truck drivers to computer scientists, some of whom believed in reincarnation and some of whom did not. He then hypnotized them individually and spent literally thousands of hours recording everything they had to say about their alleged previous existences.

Even in its broad strokes the information was fascinating. One striking aspect was the degree of agreement between the subjects' experiences. All reported numerous past lives, some as many as twenty to twenty-five, although a practical limit was reached when Whitton regressed them to what he calls their "caveman existences," when one lifetime became indistinguishable from the next.[48] All reported that gender was not specific to the soul, and many had lived at least one life as the opposite sex. And all reported that the purpose of life was to evolve and learn, and that multiple existences facilitated this process.

Whitton also found evidence that strongly suggested the experiences were actual past lives. One unusual feature was the ability the memories had to explain a wide range of seemingly unrelated events and experiences in the subjects' current lives. For example, one man, a psychologist born and raised in Canada, had possessed an inexplicable British accent as a child. He also had an irrational fear of breaking his leg, a phobia of air travel, a terrible nail-biting problem, an obsessive fascination with torture, and as a teenager had had a brief and enigmatic vision of being in a room with a Nazi officer, shortly after operating the pedals of a car during a driving test. Under hypnosis the

jdan recalled being a British pilot during World War II. While on a mission over Germany his plane was hit by a shower of bullets, one of which penetrated the fuselage and broke his leg. This in turn caused pirn to lose control of the plane's foot pedals, forcing him to crash-land. jle was subsequently captured by the Nazis, tortured for information py having his nails pulled out, and died a short time later.[48]

Many of the subjects also experienced profound psychological and physical healings as a result of the traumatic past-life memories they unearthed, and gave uncannily accurate historical details about the times in which they had lived. Some even spoke languages unknown to them. While reliving an apparent past life as a Viking, one man, a thirty-seven-year-old behavioral scientist, shouted words that linguistic authorities later identified as Old Norse.[50] After being regressed to an ancient Persian lifetime, the same man began to write in a spidery, Arabic-style script that an expert in Near Eastern languages identified as an authentic representation of Sassanid Pahlavi, a long-extinct Mesopotamian tongue that nourished between A.D. 226 and 651.[S1]

But Whitton's most remarkable discovery came when he regressed subjects to the interim between lives, a dazzling, light-filled realm in which there was "no such thing as time or space as we know it."[52] According to his subjects, part of the purpose of this realm was to allow them *to plan their next life, to literally sketch out the important events and circumstances that would befall them in the future.* But this process was not simply some fairy-tale exercise in wish fulfillment. Whitton found that when individuals were in the between-life realm, they entered an unusual state of consciousness in which they were acutely self-aware and had a heightened moral and ethical sense. In addition, they no longer possessed the ability to rationalize away any of their faults and misdeeds, and saw themselves with total honesty. To distinguish it from our normal everyday consciousness, Whitton calls this intensely conscientious state of mind "metacon-aciousness."

Thus, when subjects planned their next life, they did so with a sense Qf moral obligation. They would choose to be reborn with people whom they had wronged in a previous life so they would have the opportunity to make amends for their actions. They planned pleasant encounters with "soul mates," individuals with whom they had built a loving and mutually beneficial relationship over many lifetimes; and they scheduled "accidental" events to fulfill still other lessons and pur-

poses. One man said that as he planned his next life he visualized "a sort of clockwork instrument into which you could insert certain parts in order for specific consequences to follow,"[68]

These consequences were not always pleasant. After being regressed to a metaconscious state, a woman who had been raped when she was thirty-seven revealed that she had actually planned the event before she had come into this incarnation. As she explained, it had been necessary for her to experience a tragedy at that age in order to force her to change her "entire soul complexion" and thus break through to a deeper and more positive understanding of the meaning of life.[5"1] Another subject, a man afflicted with a serious and life-threatening kidney disease, disclosed that he had chosen the illness to punish himself for a past-life transgression. However, he also revealed that dying from the kidney disease was not part of his script, and before he had come into this life he had also arranged to encounter someone or something that would help him remember this fact and hence enable him to heal both his guilt and his body. True to his word, after he started his sessions with Whitton he experienced a near-miraculous complete recovery.[ss]

Not all of Whitton's subjects were so eager to learn about the future their metaconscious selves had laid out for them. Several censored their own memories and asked Whitton to please give them posthypnotic instructions *not* to remember anything that they had said during trance. As they explained, they did not want to be tempted to tamper with the script their metaconscious selves had written for them.[5]*

This is an astounding idea. Is it possible that our unconscious mind is not only aware of the rough outline of our destiny, but actually steers us toward its fulfillment? Whitton's research is not the only evidence that this may be the case. In a statistical study of 28 serious U.S. railroad accidents, parapsychoiogist William Cox found that significantly fewer people took trains on accident days than on the same day in previous weeks/'[7]

Cox's finding suggests that we all may be constantly unconsciously precognizing the future and making decisions based on that information: some of us opting to avoid mishap, and perhaps some—iike the woman who chose to experience a personal tragedy and the man who elected to endure a kidney disease—choosing to experience negative situations to fulfill other unconscious designs and purposes. "Carefully or haphazardly, we choose our earthly circumstances," says Whitton. "The message of metaconsciousness is that the life situation

of every human being is neither random nor inappropriate. Seen objectively from the interlife, every human experience is simply another lesson in the cosmic classroom."[58]

It is important to note that the existence of such unconscious agendas does not mean that our lives are rigidly predestined and all fates unavoidable. The fact that many of Whitton's subjects asked not to remember what they said under hypnosis implies again that the future is only roughly outlined and still subject to change.

Whitton is not the only reincarnation researcher who has uncovered evidence that our unconscious has more of a hand in our lives than we may realize. Another is Dr. Ian Stevenson, a professor of psychiatry at the University of Virginia Medical School. Instead of using hypnosis Stevenson interviews young children who have spontaneously remembered apparent previous existences. He has spent more than thirty years in this pursuit and has collected and analyzed thousands of cases from all over the globe.

According to Stevenson, spontaneous past-life recall is relatively-common among children, so common that the number of cases that seem worth considering far exceeds his staff's ability to investigate them. Generally children are between the ages of two and four when they start talking about their "other life," and frequently they remember dozens of particulars, including their name, the names of family members and friends, where they lived, what their house looked like, what they did for a living, how they died, and even obscure information such as where they hid money before they died and, in cases involving murder, sometimes even who killed them.[89]

Indeed, frequently their memories are so detailed Stevenson is able to track down the identity of their previous personality and verify virtually everything they have said. He has even taken children to the area in which their past incarnation lived, and watched as they navigated effortlessly through strange neighborhoods and correctly identified their former house, belongings, and past-life relatives and friends.

Like Whitton, Stevenson has gathered an enormous amount of data suggestive of reincarnation, and to date has published six volumes on his findings.[60] And like Whitton, he also has found evidence that the unconscious plays a far greater role in our makeup and destiny than we have hitherto suspected.

He has corroborated Whitton's finding that we are frequently reborn with individuals we have known in previous existences, and that the guiding force behind our choices is often affection or a sense of

guilt or indebtedness.[61] He agrees that personal responsibility, not chance, is the arbiter of our fate. He has found that although a person's material conditions can vary greatly from one life to the next, their moral conduct, interests, aptitudes, and attitudes remain the same. Individuals who were criminals in their previous existence tend to be drawn to criminal behavior again; people who were generous and kind continue to be generous and kind, and so on. From this Stevenson concludes that it is not the outward trappings of life that matter, but the inner ones, the joys, sorrows, and "inner growths" of the personality, that appear to be most important

Most significant of all, he found no compelling evidence of "retributive karma," or any indication that we are cosmically punished for our sins. "There is then—if we judge by the evidence of the cases—no external judge of our conduct and no being who shifts us from life to life according to our deserts. If this world is (in Keats's phrase) 'a vale of soul-making,' we are the makers of our own souls," states Stevenson.[62]

Stevenson has also uncovered a phenomenon that did not turn up in Whitton's study, a discovery that provides even more dramatic evidence of the power the unconscious mind has to sculpt and influence our life circumstances. He has found that a person's previous incarnation can apparently affect the very shape and structure of their current physical body. He has discovered, for example, that Burmese children who remember previous lives as British or American Air Force pilots shot down over Burma during World War II all have fairer hair and complexions than their siblings.[63]

He has also found instances in which distinctive facial features, foot deformities, and other characteristics have carried over from one life to the next.[64] Most numerous among these are physical injuries carrying over as scars or birthmarks. In one case, a boy who remembered being murdered in his former life by having his throat slit still had a long reddish mark resembling a scar across his neck.[65] In another, a boy who remembered committing suicide by shooting himself in the head in his past incarnation still had two scarlike birthmarks that lined up perfectly along the bullet's trajectory, one where the bullet had entered and one where it had exited.[6*] And in another, a boy had a birthmark resembling a surgical scar complete with a line of red marks resembling stitch wounds, in the exact location where his previous personality had had surgery.[67]

In fact, Stevenson has gathered hundreds of such cases and is currently compiling a four-volume study of the phenomenon. In some of the cases he has even been able to obtain hospital and/or autopsy reports of the deceased personality and show that such injuries not only occurred, but were in the exact location of the present birthmark or deformity. He feels that such marks not only provide some of the strongest evidence in favor of reincarnation, but also suggest the existence of some kind of intermediate nonphysical body that functions as a carrier of these attributes between one life and the next He states, "It seems to me that the imprint of wounds on the previous personality must be carried between lives on some kind of an extended body which in turn acts as a template for the production on a new physical body of birthmarks and deformities that correspond to the wounds on the body of the previous personality."[?SB]

Stevenson's theorized "template body" echoes Tiller's assertion that the human energy field is a holographic template that guides the form and structure of the physical body. Put another way, it is a kind of three-dimensional blueprint around which the physical body forms. Similarly, his findings regarding birthmarks add further support to the idea that we are at heart just images, holographic constructs, created by thought.

Stevenson has also noted that although his research suggests that we are the creators of our own lives and, to a certain extent, our own bodies, our participation in this process is so passive as to be almost involuntary. Deep strata of the psyche appear to be involved in these choices, strata that are much more in touch with the implicate. Or as,-Stevenson puts it, "Levels of mental activity far deeper than those that regulate the digestion of our supper in our stomach [and] our ordinary breathing must govern these processes."[G9]

As unorthodox as many of Stevenson's conclusions are, his reputation as a careful and thorough investigator has gained him respect in some unlikely quarters. His findings have been published in such distinguished scientific periodicals as the *American Journal ofPsyckia-[ir]V,* the *Journal of Nervous and Mental Disease,* and the *International Journal of Comparative Sociology.* And in a review of one of his works the prestigious *Journal of the American Medical Association* stated that he has "painstakingly and unemotionally collected a ^tailed series of cases in which the evidence for reincarnation is oimcult to understand on any other grounds. ... He has placed on 'Word a large amount of data that cannot be ignored."[70]

Thought as Builder

As with so many of the "discoveries" we have looked at, the idea that some deeply unconscious and even spiritual part of us can reach across the boundaries of time and is responsible for our destiny can also be found in many shamanic traditions and other sources. According to the Batak people of Indonesia, everything a person experiences is determined by his or her soul, or *tondi,* which reincarnates from one body to the next and is a medium capable of reproducing not only the behavior, but the physical attributes of the person's former self.[7I] The Ojibway Indians also believed a person's Me is scripted by an invisible spirit or soul and is laid out in a manner that promotes growth and development. If a person dies without completing all the lessons they need to learn, their spirit body returns and is reborn in another physical body.[73]

The kahunas call this invisible aspect the *aumakua,* or "high self." Like Whitton's metaconsciousness, it is the unconscious portion of a person that can see the parts of the future that are crystallized, or "set." It is also the part of us that is responsible for creating our destiny, but it is not alone in this process. Like many of the researchers mentioned in this book, the kahunas believed that thoughts are things and are composed of a subtle energetic substance they called *kino mea,* or "shadowy body stuff." Hence, our hopes, fears, plans, worries, guilts, dreams, and imaginings do not vanish after leaving our mind, but are turned into thought forms, and these, too, become some of the rough strands from which the high self weaves our future.

Most people are not in charge of their own thoughts, said the kahunas, and constantly bombard their high self with an uncontrolled and contradictory mixture of plans, wishes, and fears. This confuses the high self and is why most people's lives appear to be equally haphazard and uncontrolled. Powerful kahunas who were in open communication with their high selves were said to be able to help a person remake his or her future. Similarly, it was considered extremely important that people take time out at frequent intervals to think about their lives and visualize in concrete terms what they wished to happen to themselves. By doing this the kahunas asserted that people can more consciously control the events that befall them and make their own future.[Ta]

In an idea that is reminiscent of Tiller and Stevenson's notion of a

subtle intermediary body, the kahunas believed this shadowy body stuff also forms a template upon which the physical body is molded. Again it was said that kahunas who were in extraordinary attunement vrith their high self could sculpt and reform the shadowy body stuff, and hence the physical body, of another person and this was how miraculous healings were effected.[74] This view also provides an interesting parallel to some of our own conclusions as to why thoughts and images have such a powerful impact on health.

The tantric mystics of Tibet referred to the "stuff" of thoughts as *tsal* and held that every mental action produced waves of this mysterious energy. They believed the entire universe is a product of the mind and is created and animated by the collective *tsal* of all beings. Most people are unaware that they possess this power, said the Tantrists, because the average human mind functions "like a small puddle isolated from the great ocean." Only great yogis skilled at contacting the deeper levels of the mind were said to be able consciously to utilize such forces, and one of the things they did to achieve this goal was to visualize repeatedly the desired creation. Tibetan tantric texts are filled with visualization exercises, or "sadhanas," designed for such purposes, and monks of some sects, such as the Kargyupa, would spend as long as seven years in complete solitude, in a cave or a sealed room, perfecting their visualization abilities.[75]

The twelfth-century Persian Sufis also stressed the importance of visualization in altering and reshaping one's destiny, and called the subtle matter of thought *alam almithal.* Like many clairvoyants, they believed that human beings possess a subtle body controlled by chakralike energy centers. They also held that reality is divided into a series of subtler planes of being, or *Hadarat,* and that the plane of being directly adjacent to this one was a kind of template reality in which the *alam almithal* of one's thoughts formed into idea-images, which in turn eventually determined the course of one's life. The Sufis also added a twist of their own. They felt the heart chakra, or *himma,* was the agent responsible for this process, and that control of the heart chakra was therefore a prerequisite for controlling one's destiny.[76] -,

Edgar Cayce also spoke of thoughts as tangible things, a finer form °f matter and, when he was in trance, repeatedly told his clients that their thoughts created their destiny and that "thought is the builder." n has view, the thinking process is like a spider constantly spinning,

constantly adding to its web. Every moment of our lives we are creating the images and patterns that give our future energy and shape, said Cayce.[TT]

Paramahansa Yogananda advised people to visualize the future they desired for themselves and charge it with the "energy of concentration." As he put it, "Proper visualization by the exercise of concentration and willpower enables us to materialize thoughts, not only as dreams or visions in the mental realm, but also as experiences in the material realm."[78]

Indeed, such ideas can be found in a wide range of disparate sources. "We are what we think," said the Buddha. "All that we are arises with our thoughts. With our thoughts we make the world."[79] "As a man acts, so does he become. As a man's desire is, so is his destiny," states the Hindu pre-Christian Erihadaranyaka Upani-shad.[w] "All things in the world of Nature are not controlled by Fate for the soul has a principle of its own," said the fourth-century Greek philosopher lamblicbus.[81] "Ask and it will be given you------ If ye have faith, nothing shall be impossible unto you," states the Bible.[82] And, "The destiny of a person is connected with those things he himself creates and does," wrote Rabbi Steinsaltz in the kabbalistic *Thirteen-Petaied Rose.*[8]*

An Indication of Something Deeper

Even today the idea that our thoughts create our destiny is still very much in the air. It is the subject of best-selling self-help books such as Shakti Gawain's *Creative Visualization* and Louise L. Hay's *You Can Heal Your Life.* Hay, who says she cured herself of cancer by changing her mental patterning, gives hugely successful workshops on her techniques. It is the main philosophy inherent in many popular "channeled" works such as *A Course in Miracles* and Jane Roberts's Seth books.

It is also being embraced by some eminent psychologists. Jean Houston, a past president of the Association for Humanistic Psychology and current Director of the Foundation for Mind Research in Pomona, New York, discusses the idea at length in her book *The Possible Human.* Houston also gives a variety of visualization exercises in the work and even calls one "Orchestrating the Brain and Entering the Holoverse.""[4]

Ir

Another book that draws heavily on the holographic mode) to support the idea that we can use visualization to reshape our future is Mary Orser and Richard A. Zarro's *Changing Your Destiny.* In addition, Zarro is the founder of Futureshaping Technologies, a company that gives seminars on "futureshaping" techniques to businesses, and numbers both Panasonic and the International Banking and Credit Association among its clients.*[5]

Former astronaut Edgar Mitchell, the sixth man to walk on the moon and a longtime explorer of inner as well as outer space, has taken a similar tack. In 1973 he founded the Institute of Noetic Sciences, a California-based organization devoted to researching such powers of the mind. The institute is still going strong, and current projects include a massive study of the mind's role in miraculous healings and spontaneous remissions, and a study of the role consciousness plays in creating a positive global future. "We create our own reality because our inner emotional—our subconscious—reality draws us into those situations from which we learn," states Mitchell. "We experience it as strange things happening to us [and] we meet the people in our lives that we need to learn from. And so we create these circumstances at a very deep metaphysical and subconscious level."[8]*

Is the current popularity of the idea that we create our own destiny' just a fad, or is its presence in so many different cultures and times an indication of something *much* deeper, a sign that it is something all human beings intuitively know is true? At present this question remains unanswered, but in a holographic universe—a universe in which the mind *participates* with reality and in which the innermost stuff of our psyches can register as synchronicities in the objective world—the notion that we are also the sculptors of our own fate is not so farfetched. It even seems probable.

Three **Last** Pieces of Evidence

Before concluding, three last pieces of evidence deserve to be looked [a]t. Although not conclusive, each offers a peek at still other time-f&nscending abilities consciousness may possess in a holographic universe.

MASS DREAMS OF THE FUTURE

Another past-life researcher who turned up evidence suggestive that the mind has a hand in creating one's destiny was the late San Francisco-based psychologist Dr. Helen Wambach. Wambach's approach was to hypnotize groups of people in small workshops, regress them to specified time periods, and ask them a predetermined list of questions about their sex, clothing style, occupation, utensils used to eating, and so on. Over the course of her twenty-nine-year investigation of the past-life phenomenon, she hypnotized literally thousands of individuals and amassed some impressive findings.

One criticism leveled against reincarnation is that people only seeivi to remember past lives as famous or historical personages. Wambach, however, found that more than 90 percent of her subjects recalled past lives as peasants, laborers, farmers, and primitive food gatherers. Less than 10 percent remembered incarnations as aristocrats, and none remembered being anyone famous, a finding that argues against the notion that past-life memories are fantasies."[7] Her subjects were also extraordinarily accurate when it came to historical details, even obscure ones. For instance, when people remembered lives in the 1700s, they described using a three-pronged fork to eat their evening meals, but after 1790 they described most forks as having four prongs, an observation that correctly reflects the historical evolution of the fork. Subjects were equally accurate when it came to describing clothing and footwear, types of foods eaten, et cetera.[88]

Wambach discovered she could also *progress* people to future lives. Indeed, her subjects' descriptions of coming centuries were so fascinating she conducted a major future-life-progression project in France and the United States. Unfortunately, she passed away before completing the study, but psychologist Chet Snow, a former colleague of Wambach's, carried on her work and recently published the results in a book entitled *Mass Dreams of the Future.*

When the reports of the 2,500 people who participated in the project were tallied, several interesting features emerged. First, virtually all of the respondents agreed that the population of the earth had decreased dramatically. Many did not even find themselves in physical bodies in the various future time periods specified, and those who did noted that the population was much smaller than it is today.

In addition, the respondents divided up neatly into four categories, each relating a different future. One group described a joyless and

sterile future in which most people lived in space stations, wore silvery suits, and ate synthetic food. Another, the "New Agers," reported living happier and more natural lives in natural settings, in harmony nitb one another, and in dedication to learning and spiritual development. Type 3, the "hi-tech urbanites," described a bleak mechanical future in which people lived in underground cities and cities enclosed in domes and bubbles. Type 4 described themselves as post-disaster survivors living in a world that had been ravaged by some global, possibly nuclear, disaster. People in this group lived in homes ranging from urban ruins to caves to isolated farms, wore plain handsewn clothing that was often made of fur, and obtained much of their food by hunting.

"What is the explanation? Snow turns to the holographic model for the answer, and like Loye, believes that such findings suggest that there are several potential futures, or holoverses, forming in the gathering mists of fate. But like other past-iife researchers he also believes we create our own destiny, both individually and collectively, and thus the four scenarios are really a glimpse into the various potential futures the human race is creating for itself en masse.

Consequently, Snow recommends that instead of building bomb shelters or moving to areas that won't be destroyed by the "coming Earth changes" predicted by some psychics, we should spend time believing in and visualizing a positive future. He cites the Planetary Commission—the ad hoc collection of millions of individuals around the world who have agreed to spend the hour of 12:00 to 1:00 P.M., Greenwich mean time, each December thirty-first united in prayer and meditation on world peace and healing—as a step in the right direction. "If we are continually shaping our future physical reality by today's collective thoughts and actions, then the time to wake up to the alternative we have created is *now,"* states Snow. "The choices between the kind of Earth represented by each of the Types are clear. Which do we want for our grandchildren? Which do we want perhaps to return to ourselves someday?""[9]

CHANGING THE PAST

The future may not be the only thing that can be formed and reshaped by human thought. At the 1988 Annual Convention of the Parapsychologieal Association, Helmut Schmidt and Marilyn Schlitz announced that several experiments they had conducted indicated the

mind may be able to alter the past as well. In one study Schmidt and Schlitz used a computerized randomization process to record 1,000 different sequences of sound. Each sequence consisted of 100 tones of varying duration, some of them pleasing to the ear and some just bursts of noise. Because the selection process was random, according to the laws of probability each sequence should contain roughly 50 percent pleasing sounds and 50 percent noise.

Cassette recordings of the sequences were then mailed to volunteers. While listening to the prerecorded cassettes the subjects were told to try to psychokinetically increase the duration of the pleasing sounds and decrease the durations of the noise. After the subjects completed the task, they notified the lab of their attempts, and Schmidt and Schlitz then examined the original sequences. They discovered that the recordings the subjects listened to contained significantly longer stretches of pleasing sounds than noise. In other words, it appeared that the subjects had psychokinetically reached back through time and had an effect on the randomized process from which their *prerecorded* cassettes had been made.

In another test Schmidt and Schlitz programmed the computer to produce 100-tone sequences randomly composed of four different notes, and subjects were instructed to try to psychokinetically cause more high notes to appear on the tapes than low. Again a retroactive PK effect was found. Schmidt and Schlitz also discovered that volunteers who meditated regularly exerted a greater PK effect than non-meditators, suggesting again that contact with the unconscious is the key to accessing the reality-structuring portions of the psyche.[90]

The idea that we can psychokinetically alter events that have already occurred is an unsettling notion, for we are so deeply programmed to believe the past is frozen as if it were a butterfly in glass, it is difficult for us to imagine otherwise. But in a holographic universe, a universe in which time is an illusion and reality is no more than a mind-created image, it is a possibility to which we may have to become accustomed.

A WALK THROUGH THE GARDEN OF TIME

As fantastic as the above two notions are, they are small change compared to the last category of time anomaly that merits our attention. On August 10, 1901, two Oxford professors, Anne Moberly, the principal of St. Hugh's College, Oxford, and Eleanor Jourdain, the vice

principal, were walking through the garden of the Petit Trianon at Versailles when they saw a shimmering effect pass over the landscape in front of them, not unlike the special effects in a movie when it changes from one scene to another. After the shimmering passed they noticed that the landscape had changed. Suddenly the people around them were wearing eighteenth-century costumes and wigs and were oehaving in an agitated manner. As the two women stood dumbfounded, a repulsive man with a pockmarked face approached and urged them to change their direction. They followed him past a line of trees to a garden where they heard strains of music floating through the air and saw an aristocratic lady painting a watercolor.

Eventually the vision vanished and the landscape returned to normal, but the transformation had been so dramatic that when the women looked behind them they realized the path they had just walked down was now blocked by an old stone wall. When they returned to England, they searched through historical records and concluded that they had been transported back in time to the day in which the sacking of the Tuileries and the massacre of the Swiss Guards had taken place—which accounted for the agitated manner of the people in the garden—and that the woman in the garden was none other than Marie Antoinette. So vivid was the experience that the women filled a book-length manuscript about the occurrence and presented it to the British Society for Psychical Research.[91]

What makes Moberly and Jourdain's experience so significant is that they did not simply have a retrocognitive vision of the past, but actually *walked back into the past,* meeting people and wandering around in the Tuileries garden as it was more than one hundred years earlier. Moberly and Jourdain's experience is difficult to accept as real, hut given that it provided them with no obvious benefit, and most certainly put their academic reputations at risk, one is hard pressed to imagine what would motivate them to make up such a story.

And it is not the only such occurrence at the Tuileries to be reported to the British Society for Psychical Research. In May 1955, a London solicitor and his wife also encountered several eighteenth-century figures in the garden. And on another occasion, the staff of an embassy whose offices overlook Versailles claims to have watched the garden revert back to an earlier period of history as well.[92] Here in the United States parapsychologist Gardner Murphy, a former president of both the American Psychological Association and the American Society for "sychical Research, investigated a similar case in which a woman

identified only by the name Buterbaugh looked out the window of her office at Nebraska Wesleyan University and saw the campus as it was fifty years earlier. Gone were the bustling streets and the sorority houses, and in their place was an open field and a sprinkling of trees, their leaves aflutter in the breeze of a summer long since passed.*[3]

Is the boundary between the present and the past so flimsy that we can, under the right circumstances, stroll back into the past with the same ease that we can stroll through a garden? At present we simply do not know, but in a world that is comprised less of solid objects traveling in space and time, and more of ghostly holograms of energy sustained by processes that are at least partially connected to human consciousness, such events may not be as impossible as they appear.

And if this seems disturbing—this idea that our minds and even our bodies are far less bound by the strictures of time than we have previously imagined—we should remember that the idea the Earth is round once proved equally frightening to a humanity convinced that it was flat. The evidence presented in this chapter suggests that we are still children when it comes to understanding the true nature of time. And like all children poised on the threshold of adulthood, we should put aside our fears and come to terms with the way the world really is. For in a holographic universe, a universe in which all things are just ghostly coruscations of energy, more than just our understanding of time must change. There are still other shimmerings to cross our landscape, still deeper depths to plumb.

8

Traveling in the Superhologram

Access to holographic reality becomes *experientiafiy* available when one's consciousness is freed from its dependence on the physical body. So long as one remains tied to the body and its sensory modalities, holographic reality *at best* can only be an intellectual construct. When one [is freed from the body] one experiences it directly. That is why mystics speak about their visions with such certitude and conviction, while those who haven't experienced this realm for themselves are left feeling skeptical or even indifferent.

—Kenneth Ring, Ph.D.
Life at Death

Time is not the only thing that is illusory in a holographic universe. Space, too, must be viewed as a product of our mode of perception. This is even more difficult to comprehend than the idea that time is a construct, for when it comes to trying to conceptualize "spacelessness" there are no easy analogies, no images of amoeboid universes or crystallizing futures, to fall back on. We are so conditioned to think in terms of space as an absolute that it is hard for us even to begin to imagine what it would be like to exist in a realm in which space did

not exist. Nonetheless, there is evidence that we are ultimately no more bound by space than we are by time.

One powerful indication that this is so can be found in out-of-body phenomena, experiences in which an individual's conscious awareness appears to detach itself from the physical body and travel to some other location. Out-of-body experiences, or OBEs, have been reported throughout history by individuals from all walks of life. Aldous Huxley, Goethe, D. H. Lawrence, August Strindberg, and Jack London a]] reported having OBEs. They were known to the Egyptians, the North American Indians, the Chinese, the Greek philosophers, the medieval alchemists, the Oceanic peoples, the Hindus, the Hebrews, and the Moslems. In a cross-cultural study of 44 non-Western societies, Dean Shiels found that only three did *not* hold a belief in OBEs.[1] In a similar study anthropologist Erika Bourguignon looked at 488 world societies—or roughly 57 percent of all known societies—and found that 437 of them, or 89 percent, had at least some tradition regarding OBEs.[2]

Even today studies indicate that OBEs are still widespread. The late Dr. Robert Crookall, a geologist at the University of Aberdeen and an amateur parapsychologist, investigated enough cases to fill nine books on the subject. In the 1960s Celia Green, the director of the Institute of Psychophysical Research in Oxford, polled 115 students at Southampton University and found that 19 percent admitted to having an OBE. When 380 Oxford students were similarly questioned, 34 percent answered in the affirmative.[3] In a survey of 902 adults Haralds-son found that 8 percent had experienced being out of their bodies at least once in their life." And a 1980 survey conducted by Dr. Harvey Irwin at the University of New England in Australia revealed that 20 percent of 177 students had experienced an 0BE.[ft] When averaged, these figures indicate that roughly one out of every five people will have an OBE at some point in his or her life. Other studies suggest the incidence may be closer to one in ten, but the fact remains: OBEs are far more common than most people realize.

The typical OBE is usually spontaneous and occurs most often during sleep, meditation, anesthesia, illness, and instances of traumatic pain (although they can occur under other circumstances as well). Suddenly a person experiences the vivid sensation that his mind has separated from his body. Frequently he finds himself floating over his body and discovers he can travel or fly to other locations. What is it like to find oneself free from the physical and staring down at one's own body? In a 1980 study of 339 cases of out-of-body travel, Dr. Glen

Gabbard of the Menninger Foundation in Topeka, Dr. Stuart Twemlow 0f the Topeka Veterans' Administration Medical Center, and Dr. powler Jones of the University of Kansas Medical Center found that a whopping *85* percent described the experience as pleasant and over half of them said it was joyful.[6]

I know the feeling. I had a spontaneous OBE as a teenager, and after recovering from the shock of finding myself floating over my body and staring down at myself asleep in bed, I had an indescribably exhilarating time flying through walls and soaring over the treetops. During the course of my bodiless journey I even stumbled across a library book a neighbor had lost and was able to tell her where the book was located the next day. I describe this experience in detail in *Beyond the Quantum.*

It is of no small significance that Gabbard, Twemlow, and Jones also studied the psychological profile of OBEers and found that they were psychologically normal and were on the whole extremely well adjusted. At the 1980 meeting of the American Psychiatric Association they presented their conclusions and told their colleagues that reassurances that OBEs are common occurrences and referring the patient to books on the subject may be "more therapeutic" than psychiatric treatment. They even hinted that patients might gain more relief by talking to a yogi than to a psychiatrist![7]

Such facts notwithstanding, no amount of statistical findings are as convincing as actual accounts of such experiences. For example, Kimberiy Clark, a hospital social worker in Seattle, Washington, did not take OBEs seriously until she encountered a coronary patient named Maria. Several days after being admitted to the hospital Maria had a cardiac arrest and was quickly revived. Clark visited her later that afternoon expecting to find her anxious over the fact that her heart had stopped. As she had expected, Maria was agitated, but not for the reason she had anticipated.

Maria told Clark that she had experienced something very strange. After her heart had stopped she suddenly found herself looking down from the ceiling and watching the doctors and the nurses working on her. Then something over the emergency room driveway distracted her and as soon as she "thought herself there, she *was* there. Next Maria "thought her way" up to the third floor of the building and found herself "eyeball to shoelace" with a tennis shoe. It was an old shoe and she noticed that the little toe had worn a hole through the fabric. She also noticed several other details, such as the fact that the

lace was stuck under the heel. After Maria finished her account she begged Clark to please go to the ledge and see if there was a shoe there so that she could confirm whether her experience was real or not

Skeptical but intrigued, Clark went outside and looked up at the ledge, but saw nothing. She went up to the third floor and began going in and out of patients' rooms looking through windows so narrow she had to press her face against the glass just to see the ledge at all. Finally, she found a room where she pressed her face against the glass and looked down and saw the tennis shoe. Still, from her vantage point she could not tell if the little toe had worn a place in the shoe or if any of the other details Maria had described were correct. It wasn't until she retrieved the shoe that she confirmed Maria's various observations. "The only way she would have had such a perspective was if she had been floating right outside and at very close range to the tennis shoe," states Clark, who has since become a believer in OBEs. "It was very concrete evidence for me."[8]

Experiencing an OBE during cardiac arrest is relatively common, so common that Michael B. Sabom, a cardiologist and professor of medicine at Emory University and a staff physician at the Atlanta Veterans' Administration Medical Center, got tired of hearing his patients recount such "fantasies" and decided to settle the matter once and for all. Sabom selected two groups of patients, one composed of 32 seasoned cardiac patients who had reported OBEs during their heart attacks, and one made up of 25 seasoned cardiac patients who had never experienced an OBE. He then interviewed the patients, asking the OBEers to describe their own resuscitation as they had witnessed it from the out-of-body state, and asking the nonexperiencers to describe what they imagined must have transpired during their resuscitation.

Of the nonexperiencers, 20 made major mistakes when they described their resuscitations, 3 gave correct but general descriptions, and 2 had no idea at all what had taken place. Among the experiencers, 26 gave correct but general descriptions, 6 gave highly detailed and accurate descriptions of their own resuscitation, and 1 gave a blow-by-blow accounting so accurate that Sabom was stunned. The results inspired him to delve even deeper into the phenomenon, and like Clark, he has now become an ardent believer and lectures widely on the subject. There appears "to be no plausible explanation for the accuracy of these observations involving the usual physical senses," he says- *"The* out-of-body hypothesis simply seems to fit best with the data at hand."[9]

Although the OBEs experienced by such patients are spontaneous, some people have mastered the ability well enough to leave their body at will- One of the most famous of these individuals is a former radio and television executive named Robert Monroe. When Monroe had his first OBE in the late 1950s he thought he was going crazy and immediately sought medical treatment. The doctors he consulted found nothing wrong, but he continued to have his strange experiences and continued to be greatly disturbed by them. Finally, after learning from a psychologist friend that Indian yogis reported leaving their bodies all the time, he began to accept his uninvited talent. "I had two options," Monroe recalls. "One was sedation for the rest of my life; the other was to learn something about this state so I could control it."[10]

From that day forward Monroe began keeping a written journal of his experiences, carefully documenting everything he learned about the out-of-body state. He discovered he could pass through solid objects and travel great distances in the twinkling of an eye simply by "thinking" himseif there. He found that other people were seldom aware of his presence, although the friends whom he traveled to see while in this "second state" quickly became believers when he accurately described their dress and activity at the time of his out-of-body visit. He also discovered that he was not alone in his pursuit and occasionally bumped into other disembodied travelers. Thus far he has catalogued his experiences in two fascinating books, *Journeys Out of the Body* and *Far Journeys.*

OBEs have also been documented in the lab. In one experiment, parapsychologist Charles Tart was able to gei a skilled OBEer he identifies only as Miss Z to identify correctly a five-digit number written on a piece of paper that could only be reached if she were floating in the out-of-body state.[13] In a series of experiments conducted at the American Society for Psychical Research in New York, Karlis Osis and psychologist Janet Lee Mitchell found several gifted subjects who were able to "fly in" from various locations around the country and correctly describe a wide range of target images, including objects placed on a table, colored geometric patterns placed on a free-floating shelf near the ceiling, and optical illusions that could only be seen when an observer peered through a small window in a special device. [u] Dr. Robert Morris, the director of research at the Psychical Research

Foundation in Durham, North Carolina, has even used animals to detect out-of-body visitations. In one experiment, for instance, Morris found that a kitten belonging to a talented out-of-body subject named Keith Harary consistently stopped meowing and started purring whenever Harary was invisibly present.[15]

OBEs as a Holographic Phenomenon

Considered as a whole the evidence seems unequivocal. Although we are taught that we "think" with our brains, this is not always true. Under the right circumstances our consciousness—the thinking, perceiving part of us—can detach from the physical body and exist just about anywhere it wants to. Our current scientific understanding cannot account for this phenomenon, but it becomes much more tractable in terms of the holographic idea,

^ Remember that in a holographic universe, location is itself an illusion. Just as an image of an apple has no specific location on a piece of holographic film, in a universe that is organized holographically things and objects also possess no definite location; everything is ultimately nonlocal, including consciousness. Thus, although our consciousness appears to be localized in our heads, under certain conditions it can just as easily appear to be localized in the upper corner of the room, hovering over a grassy lawn, or floating eyeball-to-shoelace with a tennis shoe on the third-floor ledge of a building.

If the idea of a nonlocal consciousness seems difficult to grasp, a useful analogy can once again be found in dreaming. Imagine that you are dreaming you are attending a crowded art exhibit. As you wander among the people and gaze at the artworks, your consciousness appears to be localized in the head of the person you are in the dream. But where is your consciousness really? A quick analysis will reveal that it is actually in everything in the dream, in the other people attending the exhibit, in the artworks, even in the very space of the dream. In a dream, location is also an illusion because everything— people, objects, space, consciousness, and so on—is unfolding out of the deeper and more fundamental reality of the dreamer.

Another strikingly holographic feature of the OBE is the plasticity of the form a person assumes once they are out of the body. After detaching from the physical, OBEers sometimes find themselves in a

ghostlike body that is an exact replica of their biological body. This caused some researchers in the past to postulate that human beings possess a "phantom double" not unlike the doppelganger of literature.

However, recent findings have exposed problems with this assumption. Although some OBEers describe this phantom double as naked, others find themselves in bodies that are fully clothed. This suggests that the phantom double is not a permanent energy replica of the biological body, but is instead a kind of hologram that can assume many shapes. This notion is borne out by the fact that phantom doubles are not the only forms people find themselves in during OBEs. There are numerous reports where people have also perceived themselves as balls of light, shapeless clouds of energy, and even no discernible form at all.

There is even evidence that the form a person assumes during an OBE is a direct consequence of their beliefs and expectations. For example, in his 1961 book *The Mystical Life,* mathematician J. H. M. Whiteman revealed that he experienced at least two OBEs a month during most of his adult life and recorded over two thousand such incidents. He also disclosed that he always felt like a woman trapped in a man's body, and during separation this sometimes resulted in his finding himself in female form. Whiteman experienced various other forms as well during his OB adventures, including children's bodies, and concluded that beliefs, both conscious and unconscious, were the determining factors in the form this second body assumed.[IA]

Monroe agrees and asserts that it is our "thought habits" that create our OB forms. Because we are so habituated to being in a body, we have a tendency to reproduce the same form in the OB state. Similarly, he believes it is the discomfort most people feel when they are naked that causes OBEers to unconsciously sculpt clothing for themselves when they assume a human form. "I suspect that one may modify the Second Body into whatever form is desired," says Monroe.[16]

What is our true form, if any, when we are in the disembodied state? Monroe has found that once we drop all such disguises, we are at heart a "vibrational pattern [comprised] of many interacting and resonating frequencies."[1G] This finding is also remarkably suggestive that something holographic is going on and offers further evidence that we—like all things in a holographic universe—are ultimately a frequency phenomenon which our mind converts into various holographic forms. It also adds credence to Hunt's conclusion that our consciousness is

contained, not in the brain, but in a plasmic holographic energy field that both permeates and surrounds the physical body.

The form we assume while in the OB state is not the only thing that displays this holographic plasticity. Despite the accuracy of the observations made by talented OB travelers during their disembodied jaunts, researchers have long been troubled by some of the glaring inaccuracies that crop up as well. For instance, the title of the lost library book I stumbled across during my own OBE looked bright green while I was in a disembodied state. But after I was back in my physical body and returned to retrieve the book I saw that the lettering was actually black. The literature is filled with accounts of similar discrepancies, instances in which OB travelers accurately described a distant room full of people, save that they added an extra person or perceived a couch where there was reaily a table.

In terms of the holographic idea, one explanation may be that such OB travelers have not yet fully developed the ability to convert the frequencies they perceive while in a disembodied state into a completely accurate holographic representation of consensus reality. In other words, since OBEers appear to be relying on a completely new set of senses, these senses may still be wobbly and not yet proficient at the art of converting the frequency domain into a seemingly objective construct of reality.

These nonphysica! senses are further hampered by the constraints our own self-limiting beliefs place upon them. A number of talented OB travelers have noted that once they became more at home in their second body they discovered that they could "see" in all directions at once without turning their heads. In other words, although seeing in all directions appears to be normal during the OB state, they were so accustomed to believing that they could see only through their eyes-even when they were in a nonphysical hologram of their body—that this belief at first kept them from realizing that they possessed 360-degree vision.

There is evidence that even our physical senses have fallen victim to this censorship. Despite our unwavering conviction that we see with our eyes, reports persist of individuals who possess "eyeless sight," or the ability to see with other areas of their bodies. Recently David Eisenberg, M.D., a clinical research fellow at the Harvard Medical School, published an account of two school-age Chinese sisters in Beijing who can "see" well enough with the skin in their armpits to read notes and identify colors.[17] In Italy the neurologist Cesare Lombroso studied a blind girl who could see with the tip of her nose and the lobe of her left ear.[1]* In the 1960s the prestigious Soviet Academy of Science investigated a Russian peasant woman named Rosa Kule-shova, who could see photographs and read newspapers with the tips of her fingers, and pronounced her abilities genuine. Significantly, the Soviets ruled out the possibility that Kuleshova was simply detecting the varying amounts of stored heat different colors emanate naturally—Kuleshova could read a black and white newspaper *even when it was covered with a sheet of heated glass.*[l9] Kuleshova became so renowned for her abilities that *Life* magazine eventually published an article about her.[20]

In short, there is evidence that we too are not limited to seeing only through our physical eyes. This is, of course, the message inherent in my father's friend Tom's ability to read the inscription on a watch even when it was shielded by his daughter's stomach, and also in the remote-viewing phenomenon. One cannot help but wonder if eyeless sight is actually just further evidence that reality is indeed *maya,* an illusion, and our physical body, as well as al! the seeming absoluteness of its physiology, is as much a holographic construct of our perception as our second body. Perhaps we are so deeply habituated to believing that we can see only through our eyes that even in the physical we have shut ourselves off from the full range of our perceptual capabilities.

Another holographic aspect of OBEs is the blurring of the division between past and future that sometimes occurs during such experiences. For example, Osis and Mitchell discovered that when Dr. Alex Tanous, a well-known psychic and talented OB traveler from Maine, flew in and attempted to describe the test objects they placed on a table, he had a tendency to describe items that were placed there days *later.'*[21] This suggests that the realm people enter during the OB state is one of the subtler levels of reality Bohm speaks about, a region that is closer to the implicate and hence closer to the level of reality in which the division between past, present, and future ceases to exist. Put another way, it appears that instead of tuning into the frequencies that encode the present, Tanous's mind inadvertently tuned into frequencies that contained information about the future and converted those into a hologram of reality.

That Tanous's perception of the room was a holographic phenomenon and not just a precognitive vision that took place solely in his head ,s underscored by another fact. The day of his schedule to produce an

OBE Osis asked New York psychic Christine Whiting to hold vigil in the room and try to describe any projector she might "see" visiting there. Despite Whiting's ignorance of who would be flying in or when, when Tanous made his OB visit she saw his apparition clearly and described him as wearing brown corduroy pants and a white cotton shirt, the clothing Dr. Tanous was wearing in Maine at the time of his attempt.[22]

Harary has also made occasional OB journeys into the future and agrees that the experiences are qualitatively different from other pre-cognitive experiences. "OBEs to future time and space differ from regular precognitive dreams in that I am definitely 'out' and moving through a black, dark area that ends at some lighted future scene," he states. When he makes an OB visit to the future he has sometimes even seen a silhouette of his future self in the scene, and this is not all. When the events he has witnessed eventually come to pass, *he can also sense his time-traveling OB self in the actual scene with him.* He describes this eerie sensation as "meeting myself 'behind' myself as if I were two beings," an experience that surely must put normal deja vus to shame.[23]

There are also cases on record of OB journeys into the past. The Swedish playwright August Strindberg, himself a frequent OB traveler, describes one in his book *Legends.* The occurrence took place while Strindberg was sitting in a wine shop, trying to persuade a young friend not to give up his military career. To bolster his argument Strindberg brought up a past incident involving both of them that had taken place one evening in a tavern. As the playwright proceeded to describe the event he suddenly "lost consciousness" only to find himself sitting in the tavern in question and reliving the occurrence. The experience lasted only for a few moments, and then he abruptly found himself back in his body and in the present.[24] The argument can also be made that the retrocognitive visions we examined in the last chapter in which clairvoyants had the experience that they were actually present during, and even "floating" over, the historical scenes they were describing are also a form of OB projection into the past.

Indeed, when one reads the voluminous literature now available on the OB phenomenon, one is repeatedly struck at the similarities between OB travelers' descriptions of their experiences and characteristics we have now come to associate with a holographic universe. In

addition to describing the OB state as a place where time and space Bo longer properly exist, where thought can be transformed into hologramlike forms, and where consciousness is ultimately a pattern of vibrations, or frequencies, Monroe notes that perception during OBEs seems based less on "a reflection of light waves" and more on "an impression of radiation," an observation that suggests once again that when one enters the OB realm one begins to enter Pribram's frequency domain.[25] Other OB travelers have also referred to the frequencylike quality of the Second State. For instance, Marcel Louis Forhan, a French OB experiencer who wrote under the name of "Yram," spends much of his book, *Practical Astral Projection,* trying to describe the wavelike and seemingly electromagnetic qualities of the OB realm. Still others have commented on the sense of cosmic unity one experiences during the state and have summarized it as a feeling that "everything is everything," and "I am that"[26]

As holographic as the OBE is, it is only the tip of the iceberg when it comes to more direct experience of the frequency aspects of reality. Although OBEs are only experienced by a segment of the human race, there is another circumstance under which we all come into closer contact with the frequency domain. That is when we journey to that undiscovered country from whose bourn no traveler returns. The rub, with all due respect to Shakespeare, is that some travelers *do* return. And the stories they tell are filled with features that smack once again of tilings holographic.

The Near-Death Experience

By now, nearly everyone has heard of near-death experiences, or NDEs, incidents in which individuals are declared clinically "dead," are resuscitated, and report that during the experience they left their physical body and visited what appeared to be the realm of the afterlife. In our own culture NDEs first came to prominence in 1975 when Raymond A. Moody, Jr., a psychiatrist who also has a Ph.D. in philosophy, published his best-selling investigation of the subject, *Life after Life.* Shortly thereafter Elisabeth Kubler-Ross revealed that she had simultaneously conducted similar research and had duplicated Moody's findings. Indeed, as more and more researchers began to

document the phenomenon it became increasingly clear that NDEs were not only incredibly widespread—a 1981 Gallup poll found that eight million adult Americans had experienced an NDE, or roughly one person in twenty—but provided the most compelling evidence to date for survival after death.

Like OBEs, NDEs appear to be a universal phenomenon. They are described at length in both the eighth-century Tibetan Book of the Dead and the 2,500-year-oid Egyptian Book of the Dead. In Book X of *The Republic* Plato gives a detailed account of a Greek soldier named Er, who came alive just seconds before bis funeral pyre was to be lit and said that he had left his body and went through a "passageway" to the land of the dead. The Venerable Bede gives a similar account in his eighth-century work *A History of the English Church and People,* and, in fact, in her recent book *Otherworld Journeys* Carol Zaleski, a lecturer on the study of religion at Harvard, points out that medieval literature is filled with accounts of NDEs.

NDEers also have no unique demographic characteristics. Various studies have shown that there is no relationship between NDEs and a person's age, sex, marital status, race, religion and/or spiritual beliefs, social class, educational level, income, frequency of church attendance, size of home community, or area of residence. NDEs, like lightning, can strike anyone at any time. The devoutly religious are no more likely to have an NDE than nonbelievers.

One of the most interesting aspects of the ND phenomenon is the consistency one finds from experience to experience. A summary of a typical NDE is as follows:

> A man is dying and suddenly finds himself floating above his body and watching what is going on. Within moments he travels at great speed through a darkness or a tunnel. He enters a realm of dazzling light and is warmly met by recently deceased friends and relatives. Frequently he hears indescribably beautiful music and sees sights—rolling meadows, flower-filled valleys, and sparkling streams—more lovely than anything he has seen on earth. In this light-filled world he feels no pain or fear and is pervaded with an overwhelming feeling of joy, love, and peace. He meets a "being (and or beings) of light" who emanates a feeling of enormous compassion, and is prompted by the being{s) to experience a "life review," a panoramic replay of his life. He becomes so enraptured by his experience of this greater reality that he desires nothing more than to stay. However, the being tells him that it is not his time yet and persuades him to return to his earthly life and reenter his physical body.

It should be noted this is only a general description and not all NDEs contain all of the elements described. Some may lack some of the above-mentioned features, and others may contain additional ingredients. The symbolic trappings of the experiences can also vary. For example, although NDEers in Western cultures tend to enter the realm of the afterlife by passing through a tunnel, experiences from other cultures might walk down a road or pass over a body of water to arrive in the world beyond.

Nevertheless, there is an astonishing degree of agreement among the NDEs reported by various cultures throughout history. For instance, the life review, a feature that crops up again and again in modem-day NDEs, is also described in the Tibetan Book of the Dead, the Egyptian Book of the Dead, in Plato's account of what Er experienced during his sojourn in the hereafter, and in the 2,000-year-old yogic writings of the Indian sage Patanjali. The cross-cultural similarities between NDEs has also been confirmed in formal study. In 1977, Osis and Haraldsson compared nearly nine hundred deathbed visions reported by patients to doctors and other medical personnel in both India and the United States and found that although there were various cultural differences—for example, Americans tended to view the being of light as a Christian religious personage and Indians perceived it to be a Hindu one—the "core" of the experience was substantially the same and resembled the NDEs described by Moody and Kubler-Ross.[27]

Although the orthodox view of NDEs is that they are just hallucinations, there is substantial evidence that this is not the case. As with OBEs, when NDEers are out-of-body, they are able to report details they have no normal sensory means of knowing. For example, Moody reports a case in which a woman left her body during surgery, floated into the waiting room, and saw that her daughter was wearing mismatched plaids. As it turned out, the maid had dressed the little girl so hastily she had not noticed the error and was astounded when the mother, who did not physically see the little girl that day, commented on the fact,[28] In another case, after leaving her body, a female NDEer went to the hospital lobby and overheard her brother-in-law tell a friend that it looked like he was going to have to cancel a business trip and instead be one of his sister-in-law's pallbearers. After the woman recovered, she reprimanded her astonished brother-in-law for writing her off so quickly.[29]

And these are not even the most extraordinary examples of sensory

awareness in the ND out-of-body state. NDE researchers have found that even patients who are blind, and have had no light perception for years, can see and accurately describe what is going on around them when they have left their bodies during an NDE. Kubler-Ross has encountered several such individuals and has interviewed them at length to determine their accuracy. 'To our amazement, they were able to describe the color and design of clothing and jewelry the people present wore," she states.[30]

Most staggering of all are those NDEs and deathbed visions involving two or more individuals. In one case, as a female NDEer found herself moving through the tunnel and approaching the realm of light, she saw a friend of hers coming back! As they passed, the friend telepathically communicated to her that he had died, but was being "sent back." The woman, too, was eventually "sent back" and after she recovered she discovered that her friend had suffered a cardiac arrest at approximately the same time of her own experience.[31]

There are numerous other cases on record in which dying individuals knew who was waiting for them in the world beyond before news of the person's death arrived through normal channels.[32]

And if there is still any doubt, yet another argument against the idea that NDEs are hallucinations is their occurrence in patients who have flat EEGs. Under normal circumstances whenever a person talks, thinks, imagines, dreams, or does just about anything else, their EEG registers an enormous amount of activity. Even hallucinations measure on the EEG. But there are many eases in which people with flat EEGs have had NDEs. Had their NDEs been simple hallucinations, they would have registered on their EEGs.

In brief, when all these facts are considered together—the widespread nature of the NDE, the absence of demographic characteristics, the universality of the core experience, the ability of NDEers to see and know things they have no normal sensory means of seeing and knowing, and the occurrence of NDEs in patients who have flat EEGs—the conclusion seems inescapable: People who have NDEs are not suffering from hallucinations or delusional fantasies, *but are actually making visits to an entirely different level of reality.*

This is also the conclusion reached by many NDE researchers. One such researcher is Dr. Melvin Morse, a pediatrician in Seattle, Washington. Morse first became interested in NDEs after treating a seven-year-old drowning victim. By the time the little girl was resuscitated she was profoundly comatose, had fixed and dilated pupils, no muscle

reflexes, and no cornea) response. In medical terms this gave her a Glascow Coma Score of three, indicating that she was in a coma so deep she had almost no chance of ever recovering. Despite these odds, she made a full recovery and when Morse looked in on her for the first time after she regained consciousness she recognized him and said that she had watched him working on her comatose body. When Morse questioned her further she explained that she had left her body and passed through a tunnel into heaven where she had met "the Heavenly Father." The Heaveniy Father told her she was not really meant to be there yet and asked if she wanted to stay or go back. At first she said she wanted to stay, but when the Heavenly Father pointed out that that decision meant she would not be seeing her mother again, she changed her mind and returned to her body.

Morse was skeptical but fascinated and from that point on set out to learn everything he could about NDEs. At the time, he worked for an air transport service in Idaho that carried patients to the hospital, and this afforded him the opportunity to talk with scores of resuscitated children. Over a ten-year period he interviewed every child survivor of cardiac arrest at the hospital, and over and over they told him the same thing. After going unconscious they found themselves outside their bodies, watched the doctors working on them, passed through a tunnel, and were comforted by luminous beings.

Morse continued to be skeptical, and in his increasingly desperate search for some logical explanation he read everything he could find on the side effects of the drugs his patients were taking, and explored various psychological explanations, but nothing seemed to fit. "Then one day I read a long article in a medical journal that tried to explain NDEs as being various tricks of the brain," says Morse. "By then I had studied NDEs extensively and none of the explanations that this researcher listed made sense. It was finally clear to me that he had missed the most obvious explanation of all—NDEs are real. He had missed the possibility that the soul really does travel."[33]

Moody echoes the sentiment and says that twenty years of research have convinced him that NDEers have indeed ventured into another level of reality. He believes that most other NDE researchers feel the same. "I have talked to almost every NDE researcher in the world about his or her work. I know that most of them believe in their hearts that NDEs are a glimpse of life after life. But as scientists and people °f medicine, they still haven't come up with 'scientific proof that a part of us goes on living after our physical being is dead. This lack of proof

keeps them from going public with their true feelings."[3"]

As a result of his 1981 survey, even George Gallup, Jr., the president of the Gallup Poll, agrees: "A growing number of researchers have been gathering and evaluating the accounts of those who have had strange near-death encounters. And the preliminary results have been highly suggestive of some sort of encounter with an extradimensional realm of reality. Our own extensive survey is the latest in these studies and is also uncovering some trends that point toward a super parallel universe of some sort."[311]

A Holographic Explanation of the Near-Death Experience

These are astounding assertions. What is even more astounding is that the scientific establishment has for the most part ignored both the conclusions of these researchers and the vast body of evidence that compels them to make such statements. The reasons for this are complex and varied. One is that it is currently not fashionable in science to consider seriously any phenomenon that seems to support the idea of a spiritual reality, and, as mentioned at the beginning of this book, beliefs are like addictions and do not surrender their grip easily. Another reason, as Moody mentions, is the widespread prejudice among scientists that the only ideas that have any value or significance are those that can be proven in a strict scientific sense. Yet another is the inability of our current scientific understanding of reality even to begin to explain NDEs if they are real.

This last reason, however, may not be the problem it seems. Several NDE researchers have pointed out that the holographic model offers us a way to understand these experiences. One such researcher is Dr. Kenneth Ring, a professor of psychology at the University of Connecticut and one of the first NDE researchers to use statistical analysis and standardized interviewing techniques to study the phenomenon. In his 1980 book *Life at Death,* Ring spends considerable time arguing in favor of a holographic explanation of the NDE. Put bluntly, Ring beiieves that NDEs are also ventures into the more frequencylike aspects of reality.

Ring bases his conclusion on the numerous suggestively holo-

graphic aspects of the NDE. One is the tendency of experiences to describe the world beyond as a realm composed of "light," "higher vibrations," or "frequencies." Some NDEers even refer to the celestial music that often accompanies such experiences as more "a combination of vibrations" than actual sounds—observations that Ring believes are evidence that the act of dying involves a shift of consciousness away from the ordinary world of appearances and into a more holographic reality of pure frequency. NDEers also frequently say that the realm is suffused with a light more brilliant than any they have ever seen on earth, but one that, despite its unfathomable intensity, does not hurt the eyes, characterizations that Ring feels are further evidence of the frequency aspects of the hereafter.

"Another feature Ring finds undeniably holographic is NDEers' descriptions of time and space in the afterlife realm. One of the most commonly reported characteristics of the world beyond is that it is a dimension in which time and space cease to exist. "I found myself in a space, in a period of time, I would say, where all space and time was negated," says one NDEer clumsily.[36] "It *has* to be out of time and space. It *must* be, because ... it can't be put *into* a time thing," says another.[37] Given that time and space are collapsed and location has no meaning in the frequency domain, this is precisely what we would expect to find if NDEs take place in a holographic state of consciousness, says Ring.

If the near-death realm is even more frequencylike than our own level of reality, why does it appear to have any structure at all? Given that both OBEs and NDEs offer ample evidence that the mind can exist independently of the brain, Ring believes it is not too farfetched to assume that it, too, functions holographically. Thus, when the mind is in the "higher" frequencies of the near-death dimension, it continues to do what it does best, translate those frequencies into a world of appearances. Or as Ring puts it, "I believe that this is a realm that is created by *interacting thought structures.* These structures or 'thought-forms' combine to form patterns, just as interference waves form patterns on a holographic plate. And just as the holographic image appears to be fully real when illuminated by a laser beam, so the images produced by interacting thought-forms appear to be real."[3*]

Ring is not alone in his speculations. In the keynote address for the 1989 meeting of the International Association for Near-Death Studies UANDS), Dr. Elizabeth W. Fenske, a clinical psychologist in private

St?™ t ^announced that she, too, believes that NDEs are journeys into a holographic realm of higher frequencies She agrees mth Ring's hypothesis that the landscapes, fleers, physical ESS ™? ^ SS^S fashionedS of mteractung <o,: mterfemg) thought patterns. "I think we've come E^ITS K? TfT* daBcult to make a distinction between fought and light In the near^eath experience thought seems to be light," she observes."

Heaven as Hologram

In addition to those mentioned by Bing and Fenske, the NDE has numerous other features that are markedly holographic iS OBEers, after NDEers have detached from the physlLuhey find £3 u f ** t0TmS, 6ither M a d^bodied cloud of "5' * as a h^mlike body sculpted by thought When the kttyr the case, the mind For example one surpnV says that when he first emerged from his body he looked "something hke a jellyfish" and fell lightly to the floor like a soap bubble ?hen he qu.ckly expanded into a ghostly three-dimensional fmage of a naked hTar^T' ^ PreSen Ce tWo WOman in the «barrmed dS^ft? £e6ling y to become clothed the women, however, never offered any indication that they were able to see any of this).

thWn^Ur innermost *?n^s and de^es are responsible for creating the form we assume m the afterlife dimension is evident in the experf thTnh f NDEerS PeoPie Who « COnfined ta whee chaff n f„d7"yS,Ca A eX'?nCe find themSeives h heaith? bodi<* that c^n run and aW Amputees mvariably have their limbs back. The elderly often mhab,t youthful bodies, and even stranger, children frequent y see themselves as adults, a fact that may reflect every child'Xtesy Sat in of may be a ^^o indttiS that m our souls some of us are much older than we realize

These hobgramhke bodies can be remarkably detailed In the incident mvolvmg the man who became embarrassed at his ownnakedness, for example, the clothing he materialized for himsTwas so met.cuk.usly wrought that he could even make out the seamsintne

material!"[1] Similarly, another man who studied his hands while in the ND state said they were "composed of light with tiny structures in them" and when he looked closely he could even see "the delicate whorls of his fingerprints and tubes of light up his arms."[42]

Some of Whitton's research is also relevant to this issue. Amazingly, when Whitton hypnotized patients and regressed them to the between-life state, they too reported all the classic features of the NDE, passage through a tunnel, encounters with deceased relatives and/or "guides," entrance into a splendorons light-filled realm in which time and space no longer existed, encounters with luminous beings, and a life review. In fact, according to Whitton's subjects the main purpose of the liie review was to refresh their memories so they could more mindfully plan their next life, a process in which the beings of light gently and noncoercively assisted.

Like Ring, after studying the testimony of his subjects Whitton concluded that the shapes and structures one perceives in the afterlife dimension are thought-forms created by the mind. "Rene Descartes' famous dictum, 'I think, therefore I am,' is never more pertinent than in the between-life state," says Whitton. "There is no experience of existence without thought.""[13]

This was especially true when it came to the form Whitton's patients assumed in the between-life state. Several said they didn't even have a body unless they were thinking. "One man described it by saying that if he stopped thinking he was merely a cloud in an endless cloud, undifferentiated," he observes. "But as soon as he started to think, he became himself^ (a state of affairs that is oddly reminiscent of the subjects in Tart's mutual hypnosis experiment who discovered they didn't have hands unless they *thought* them into existence). At first the bodies Whitton's subjects assumed resembled the persons they had been in their last life. But as their experience in the between-life state continued, they gradually became a kind of hologramlike composite of all of their past lives.[45] This composite identity even had a name separate from any of the names they had used in their physical incarnations, although none of his subjects was able to pronounce it using their physical vocal cords.[s]

What do NDEers look like when they have not constructed a hologram like body for themselves? Many say that they were not aware of any form and were simply "themselves" or "their mind." Others have more specific impressions and describe themselves as "a cloud of colors," "a mist," "an energy pattern," or "an energy field," terms that

again suggest that we are all ultimately just frequency phenomena, patterns of some unknown vibratory energy enfolded in the greater matrix of the frequency domain. Some NDEers assert that in addition to being composed of colored frequencies of light, we are also constituted out of sound. "I realized that each person and thing has its own musical tone range as well as its own color range," says an Arizona housewife who had an NDE during childbirth, "If you can imagine yourself effortlessly moving in and out among prismatic rays of light and hearing each person's musical notes join and harmonize with your own when you touch or pass them, you would have some idea of the unseen world." The woman, who encountered many individuals in the afterlife realm who manifested only as clouds of colors and sound, believes the mellifluous tones each soul emanates are what people are describing when they say they hear beautiful music in the ND dimension."[7]

Like Monroe, some NDEers report being able to see in all directions at once while in the disembodied state. After wondering what he looked like, one man said he suddenly found himself staring at his own back.[48] Robert Sullivan, an amateur NDE researcher from Pennsylvania who specializes in NDEs by soldiers during combat, interviewed a World War II veteran who temporarily retained this ability even after he returned to his physical body. "He experienced three-hundred-sixty-degree vision while running away from a German machine-gun nest," says Sullivan. "Not only could he see ahead as he ran, but he could see the gunners trying to draw a bead on him from behind."-[19]

Instantaneous Knowledge

Another part of the NDE that possesses many holographic features is the life review. Ring refers to it as "a holographic phenomenon par excellence." Grof and Joan Halifax, a Harvard medical anthropologist and the coauthor (with Grof) of *The Human Encounter with Death.,* have also commented on the life review's holographic aspects. According to several NDE researchers, including Moody, even many NDEers themselves use the term "holographic" when describing the experience.[50]

The reason for this characterization is obvious as soon as one begins to read accounts of the life review. Again and again NDEers use the

same adjectives to describe it, referring to it as an incredibly vivid, wrap-around, three-dimensional replay of their entire life. "It's like climbing right inside a movie of your life," says one NDEer. "Every moment from every year of your life is played back in complete sen sory detail. Total, total recall. And it all happens in an instant"[5'] "The whole thing was really odd. I was there; I was actually seeing these flashbacks; I was actually walking through them, and it was so fast Yet, it was slow enough that I could take it all in," says another.[62] During this instantaneous and panoramic remembrance NDEers reexperience al! the emotions, the joys and the sorrows, that accompa nied all of the events in their life. More than that, they feel all of the emotions of the people with whom they have interacted as well. They feel the happiness of all the individuals to whom they've been kind. If they have committed a hurtful act, they become acutely aware of the pain their victim felt as a result of their thoughtlessness. And no event seems too trivial to be exempt While reliving a moment in her child hood, one woman suddenly experienced all the loss and powerlessness her sister had felt after she (then a child) snatched a toy away from her sister. *_

Whitton has uncovered evidence that thoughtless acts are not the only things that cause individuals remorse during the life review. Under hypnosis his subjects reported that failed dreams and aspirations—things they had hoped to accomplish during their life but had not—also caused them pangs of sadness-Thoughts, too, are replayed with exacting fidelity during the life review. Reveries, faces glimpsed once but remembered for years, things that made one laugh, the joy one felt when gazing at a particular painting, childish worries, and long forgotten daydreams—all flit through one's mind in a second. As one NDEer summarizes, "Not even your thoughts are lost . . . Every thought was there."[33]

And so, the life review is holographic not only in its three-dimensionality, but in the amazing capacity for information storage the process displays. It is also holographic in a third way. Like the kabbalistic ["aleph," a mythical point in space and time that contains all other points in space and time, it is a moment that contains all other moments. Even the ability to perceive the life review seems holographic in that it is a faculty capable of experiencing something that is paradoxically at once both incredibly rapid and yet slow enough to witness in detail. As an NDEer in 1821 put it, it is the ability to "simultaneously comprehend the whole and every part."[64]

In fact, the life review bares a marked resemblance to the afterlife judgment scenes described in the sacred texts of many of the world's great religions, from the Egyptian to the Judeo-Christian, but with one crucial difference. Like Whitton's subjects, NDEers universally report that they are *never judged by the beings of light,* but feel only love and acceptance in their presence. *The only judgment that ever takes place is self-judgment and arises solely out of the NDEer's own feelings of guilt and repentance.* Occasionally the beings do assert themselves, but instead of behaving in an authoritarian manner, they act as guides and counselors whose only purpose is to teach.

This total lack of cosmic judgment and/or any divine system of punishment and reward has been and continues to be one of the most controversial aspects of the NDE among religious groups, but it is one of the most oft reported features of the experience. What is the explanation? Moody believes it is as simple as it is polemic. We live in a universe that is far more benevolent than we realize.

That is not to say that anything goes during the life review. Like Whitton's hypnotic subjects, after arriving in the realm of light NDEers appear to enter a state of heightened or metaconsciousness awareness and become lucidly honest in their self-reflections.

It also does not mean that the beings of light prescribe no values. In NDE after NDE they stress two things. One is the importance of love. Over and over they repeat this message, that we must learn to replace anger with love, learn to love more, learn to forgive and love everyone unconditionally, and learn that we in turn *are* loved. This appears to be the only moral criterion the beings use. Even sexual activity ceases to possess the moral stigma we humans are so fond of attaching to it. One of Whitton's subjects reported that after living several withdrawn and depressed incarnations he was urged to plan a life as an amorous and sexually active female in order to add balance to the overall development of his soul.[55] It appears that in the minds of the beings of light, compassion is the barometer of grace, and time and time again when NDEers wonder if some act they committed was right or wrong, the beings counter their inquiries only with a question: Did you do it out of love? Was the motivation love?

That is why we have been placed here on the earth, say the beings, to learn that love is the key. They acknowledge that it is a difficult undertaking, but intimate that it is crucial to both our biological and spiritual existence in ways that we have perhaps not even begun to fathom. Even children return from the near-death realm with this

message firmly impressed in their thoughts. States one little boy who after being hit by a car was guided into the world beyond by two people in "very white" robes: "What I learned there is that the most important thing is loving while you are alive."[56]

The second thing the beings emphasize is knowledge. Frequently NDEers comment that the beings seemed pleased whenever an incident involving knowledge or learning flickered by during their life review. Some are openly counseled to embark on a quest for knowledge after they return to their physical bodies, especially knowledge related to self-growth or that enhances one's ability to help other people. Others are prodded with statements such as "learning is a continuous process and goes on even after death" and "knowledge is one of the few things you will be able to take with you after you have died."

The preeminence of knowledge in the afterlife dimension is apparent in another way. Some NDEers discovered that in the presence of the light they suddenly had direct access to *all* knowledge. This access manifested in several ways. Sometimes it came in response to inquiries. One man said that all he had to do was ask a question, such as what would it be like to be an insect, and instantly the experience was his.[57] Another NDEer described it by saying, "You can think of a question . . . and *immediately* know the answer to it. As simple as that. And it can be any question whatsoever. It can be on a subject that you don't know anything about, that you are not in the proper position even to understand and the light will give you the instantaneous correct answer and make you understand it."[58]

Some NDEers report that they didn't even have to ask questions in order to access this infinite library of information. Following their life review they just suddenly knew everything, all the knowledge there was to know from the beginning of time to the end. Others came into contact with this knowledge after the being of light made some specific gesture, such as wave its hand. Still others said that instead of acquiring the knowledge, they *remembered* it, but forgot most of what they recalled as soon as they returned to their physical bodies (an amnesia that seems to be universal among NDEers who are privy to such visions).[53] Whatever the case, it appears that once we are in the world beyond, it is no longer necessary to enter an altered state of consciousness in order to have access to the transpersona! and infinitely interconnected informational realm experienced by Grof s patients.

In fact, the life review bares a marked resemblance to the afterlife judgment scenes described in the sacred texts of many of the world's great religions, from the Egyptian to the Judeo-Christian, but with one crucial difference. Like Whitton's subjects, NDEers universally report that they are *never judged by the beings of light,* but feel only Jove and acceptance in their presence. *The only judgment that ever takes place is self-judgment and arises solely out of the NDEer's own feelings of guilt and repentance.* Occasionally the beings do assert themselves, but instead of behaving in an authoritarian manner, they act as guides and counselors whose only purpose is to teach.

This total lack of cosmic judgment and/or any divine system of punishment and reward has been and continues to be one of the most controversial aspects of the NDE among religious groups, but it is one of the most oft reported features of the experience. What is the explanation? Moody believes it is as simple as it is polemic. We live in a universe that is far more benevolent than we realize.

That is not to say that anything goes during the life review. Like Whitton's hypnotic subjects, after arriving in the realm of light NDEers appear to enter a state of heightened or metaconsciousness awareness and become lucidly honest in their self-reflections.

It also does not mean that the beings of light prescribe no values. In NDE after NDE they stress two things. One is the importance of love. Over and over they repeat this message, that we must learn to replace anger with love, learn to love more, learn to forgive and love everyone unconditionally, and learn that we in turn *are* loved. This appears to be the only moral criterion the beings use. Even sexual activity ceases to possess the moral stigma we humans are so fond of attaching to it. One of Whitton's subjects reported that after living several withdrawn and depressed incarnations he was urged to plan a life as an amorous and sexually active female in order to add balance to the overall development of his soul.[ss] It appears that in the minds of the beings of light, compassion is the barometer of grace, and time and time again when NDEers wonder if some act they committed was right or wrong, the beings counter their inquiries only with a question: Did you do it out of love? Was the motivation love?

That is why we have been placed here on the earth, say the beings, to learn that love is the key. They acknowledge that it is a difficult undertaking, but intimate that it is crucial to both our biological and spiritual existence in ways that we have perhaps not even begun to fathom. Even children return from the near-death realm with this

message firmly impressed in their thoughts. States one little boy who after being hit by a car was guided into the world beyond by two people in "very white" robes: "What I learned there is that the most important thing is loving while you are alive."[S6]

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In addition to being holographic in all the ways already mentioned, this vision of total knowledge has another holographic characteristic. NDEers often say that during the vision the information arrives in "chunks" that register instantaneously in one's thoughts. In other words, rather than being strung out in a linear fashion like words in a sentence or scenes in a movie, all the facts, details, images, and pieces of information burst into one's awareness in an instant. One NDEer referred to these bursts of information as "bundles of thought"*[0] Monroe, who has also experienced such instantaneous explosions of information while in the OB state, calls them "thought balls."[61]

Indeed, anyone who possesses any appreciable psychic ability is familiar with this experience, for this is the form in which one receives psychic information as well. For instance, sometimes when I meet a stranger {and on occasion even when I just hear a person's name), a thought ball of information about that person will instantly flash into my awareness. This thought ball can include important facts about the person's psychological and emotional makeup, their health, and even scenes from their past. I find that I am especially prone to getting thought balls about people who are in some kind of crisis. For example, recently I met a woman and instantly knew she was contemplating suicide. I also knew some of the reasons why. As I always do in such situations, I started talking to her and cautiously maneuvered the conversation to things psychic. After finding out that she was receptive to the subject, I confronted her with what I knew and got her to talk about her problems. I got her to promise to seek some kind of professional counseling instead of the darker option she was considering.

Receiving information in this manner is similar to the way one becomes aware of information while dreaming. Virtually everyone has had a dream in which they find themselves in a situation and suddenly know all kinds of things about it without being told. For instance, you might dream you are at a party and as soon as you are there you know who it is being given for and why. Similarly, everyone has had a detailed idea or inspiration dawn upon them in a flash. Such experiences are lesser versions of the thought ball effect.

Interestingly, because these bursts of psychic information arrive in nonlinear chunks, it sometimes takes me several moments to translate them into words. Like the psychological gestalts experienced by individuals during transpersonal experiences, they are holographic in

the sense that they are instantaneous "wholes" our time-oriented minds must struggle with for a moment in order to unravel and convert into a serial arrangement of parts.

What form does the knowledge contained in the thought balls experienced during NDEs take? According to NDEers all forms of communication are used, sounds, moving hologramlike images, even telepathy—a fact that Ring believes demonstrates once again that the hereafter is "a world of existence where thought is king."[62]

The thoughtful reader may immediately wonder why the quest for learning is so important during life if we have access to all knowledge after we die? When asked this question NDEers replied that they weren't certain, but felt strongly that it had something to do with the purpose of life and the ability of each individual to reach out and help others. -^

Life Plans and Parallel Time Tracks

Like Whitton, NDE researchers have also uncovered evidence that our lives are planned beforehand, at least to some extent, and we each play a role in the creation of this plan. This is apparent in several aspects of the experience. Frequently after arriving in the world of light, NDEers are told that "it is not their time yet." As Ring points out, this remark clearly implies the existence of some kind of "life plan."[63] It is also clear that NDEers play a role in the formulation of these destinies, for they are often given the *choice* whether to return or stay. There are even instances of NDEers being told that it *is* their time and still being allowed to return. Moody cites a case in which a man started to cry when he realized he was dead because he was afraid his wife wouldn't be able to raise their nephew without him. On hearing this the being told him that since he wasn't asking for himself he would be allowed to return.[M] In another case a woman argued that she hadn't danced enough yet. Her remark caused the being of light to give a hearty laugh and she, too, was given permission to return to physical life.*[s]

That our future is at least partially sketched out is also evident in a phenomenon Ring calls the "personal flashforward." On occasion, during the vision of knowledge, NDEers are shown glimpses of their own future. In one particularly striking case a child NDEer was told

various specifics about his future, including the fact that he would be married at age twenty-eight and would have two children. He was even shown his adult self and his future children sitting in a room of the house he would eventually be living in, and as he gazed at the room he noticed something very strange on the wall, something that his mind could not grasp. Decades later and after each of these predictions had come to pass, he found himself in the very scene he had witnessed as a child and realized that the strange object on the wall was a "forced-air heater," a kind of heater that had not yet been invented at the time of his NDE.[66]

In another equally astonishing personal flashforward a female NDEer was shown a photograph of Moody, told his full name, and told that when the time was right she would tell him about her experience. The year was 1971 and Moody had not yet published *Life after Life,* so his name and picture meant nothing to the woman. However, the time became "right" four years later when Moody and his family unwittingly moved to the very street on which the woman lived. That Halloween Moody's son was out trick-or-treating and knocked on the woman's door. After hearing the boy's name, the woman told him to tell his father she had to talk to him, and when Moody obliged she related her remarkable story.[BT]

Some NDEs even support Loye's proposal that several holographic parallel universes, or time tracks, exist. On occasion NDEers are shown personal flashforwards and told that the future they have witnessed will come to pass *only if they continue on their current path.* In one unique instance an NTDEer was shown a completely different history of the earth, a history that would have developed if "certain events" had not taken place around the time of the Greek philosopher and mathematician Pythagoras three thousand years ago. The vision revealed that if these events, the precise nature of which the woman does not disclose, had failed to take place, we would now be living in a world of peace and harmony marked "by the absence of religious wars and of a Christ figure."[6]* Such experiences suggest that the laws of time and space operative in a holographic universe may be very strange indeed.

Even NDEers who do not experience direct evidence of the role they play in their own destiny often come back with a firm understanding of the holographic interconnectedness of all things. As a sixty-two-year-old businessman who had an NDE during a cardiac arrest puts

it "One thing 1 learned was that we are all part of one big, living universe. If we think we can hurt another person or another living thing without hurting ourselves we are sadly mistaken. I look at a forest or a flower or a bird now, and say, 'That is me, part of me.' We are connected with all things and if we send love along those connections, then we are happy."[69]

You Can Eat but You Don't Have To

The holographic and mind-created aspects of the near-death dimension are apparent in myriad other ways. In describing the hereafter one child said that food appeared whenever she wished for it, but there was no need to eat, an observation that underscores once again the illusory and hologramlike nature of afterlife reality.[70] Even the symbolic language of the psyche is given "objective" form. For example, one of Whitton's subjects said that when he was introduced to a woman who was going to figure prominently in his next life, instead of appearing as a human she appeared as a shape that was half-rose, half-cobra. After being directed to figure out the meaning of the symbolism, he realized that he and the woman had been in love with one another in two other lifetimes. However, she had also twice been responsible for his death. Thus, instead of manifesting as a human, the loving and sinister elements of her character caused her to appear in a hologramlike form that better symbolized these two dramatically polar qualities.[71]

Whitton's subject is not alone in his experience. Hazrat Inayat Khan said that when he entered a mystical state and traveled to "divine realities," the beings he encountered also occasionally appeared in half-human, half-animal forms. Like Whitton's subject, Khan discerned that these transfigurations were symbolic, and when a being appeared as part animal it was because the animal symbolized some quality the being possessed. For example, a being that had great strength might appear with the head of a lion, or a being that was unusually smart and crafty might have some of the features of a fox. Khan theorized that this is why ancient cultures, such as the Egyptian, pictured the gods that rule the afterlife realm as having animal heads,[72]

The propensity near-death reality has for molding itself into hologramlike shapes that mirror the thoughts, desires, and symbols that populate our minds explains why Westerners tend to perceive the beings of light as Christian religious figures, why Indians perceive them as Hindu saints and deities, and so on. The plasticity of the ND realm suggests that such outward appearances may be no more or less real than the food wished into existence by the little girl mentioned above, the woman who appeared as an amalgam of a cobra and a rose, and the spectral clothing conjured into existence by the NDEer who was embarrassed at his own nakedness. This same plasticity explains the other cultural differences one finds in near-death experiences, such as why some NDEers reach the hereafter by traveling through a tunnel, some by crossing a bridge, some by going over a body of water, and some simply by walking down a road. Again it appears that in a reality created solely out of interacting thought structures, even the landscape itself is sculpted by the ideas and expectations of the ex-periencer.

At this juncture an important point needs to be made. As startling and foreign as the near-death realm seems, the evidence presented in this book reveals that our own level of existence may not be all that different. As we have seen, we too can access all information, it is just a little more difficult for us. We too can occasionally have personal flashforwards and come face-to-face with the phantasmal nature of time and space. And we too can sculpt and reshape our bodies, and sometimes even our reality, according to our beliefs, it just takes us a little more time and effort. Indeed, Sai Baba's abilities suggest that we can even materialize food simply by wishing for it, and Therese Neumann's inedia offers evidence that eatbg may ultimately be as unnecessary for us as it is for individuals in the near-death realm.

In fact, it appears that this reality and the next are different in degree, but not in kind. Both are hologramlike constructs, realities that are established, as Jahn and Dunne put it, only by the interaction of consciousness with its environment. Put another way, our reality appears to be a more frozen version of the afterlife dimension. It takes a little more time for our beliefs to resculpt our bodies into things like nail-like stigmata and for the symbolic language of our psyches to manifest externally as synchronises. But manifest they do, in a slow and inexorable river, a river whose persistent presence teaches us that we live in a universe we are only just beginning to understand.

Information about the Near-Death Realm from Other Sources

One does not have to be in a life-threatening crisis to visit the afterlife dimension. There is evidence that the ND realm can also be reached during OBEs. In his writings, Monroe describes several visits to levels of reality in which he encountered deceased friends,[73] An even more skilled out-of-body visitor to the land of the dead was Swedish mystic Swedenborg. Born in 1688, Swedenborg was the Leonardo da Vinci of his era. In his early years he studied science. He was the leading mathematician in Sweden, spoke nine languages, was an engraver, a politician, an astronomer, and a businessman, built watches and microscopes as a hobby, wrote books on metallurgy, color theory, commerce, economics, physics, chemistry, mining, and anatomy, and invented prototypes for the airplane and the submarine.

Throughout all of this he also meditated regularly, and when he reached middle age, developed the ability to enter deep trances during which he left his body and visited what appeared to him to be heaven and conversed with "angels" and "spirits." That Swedenborg was experiencing something profound during these journeys, there can be no doubt. He became so famous for this ability that the queen of Sweden asked him to find out why her deceased brother had neglected to respond to a letter she had sent him before his death. Swedenborg promised to consult the deceased and the next day returned with a message which the queen confessed contained information only she and her dead brother knew. Swedenborg performed this service several times for various individuals who sought his help, and on another occasion told a widow where to find a secret compartment in her deceased husband's desk in which she found some desperately needed documents. So well known was this latter incident that it inspired the German philosopher Immanuel Kant to write an entire book on Swedenborg entitled *Dreams of a Spirit-Seer,*

But the most amazing thing about Swedenborg's accounts of the afterlife realm is how closely they mirror the descriptions offered by modern-day NDEers. For example, Swedenborg talks about passing through a dark tunnel, being met by welcoming spirits, landscapes more beautiful than any on earth and one where time and space no longer exist, a dazzling light that emitted a feeling of love, appearing before beings of light, and being enveloped by an all-encompassing

peace and serenity.[74] He also says that he was allowed to observe firsthand the arrival of the newly deceased in heaven, and watch as they were subjected to the life review, a process he called "the opening of the Book of Lives." He acknowledged that during the process a person witnessed "everything they had ever been or done," but added a unique twist According to Swedenborg, the information that arose during the opening of the Book of Lives was recorded in the nervous system of the person's spiritual body. Thus, in order to evoke the life review an "angel" had to examine the individual's entire body "beginning with the fingers of each hand, and proceeding through the whole.""

Swedenborg also refers to the holographic thought balls the angels use to communicate and says that they are no different from the portrayals he could see in the "wave-substance" that surrounded a person. Like most NDEers he describes these telepathic bursts of knowledge as a picture language so dense with information that each image contains a thousand ideas. A communicated series of these portrayals can also be quite lengthy and "last up to several hours, in such a sequential arrangement that one can only marvel."[76]

But even here Swedenborg added a fascinating twist. In addition to using portrayals, angels also employ a speech that contains concepts that are beyond human understanding. In fact, the main reason they use portrayals is because it is the only way they can make even a pale version of their thoughts and ideas comprehensible to human beings.[77] Swedenborg's experiences even corroborate some of the less commonly reported elements of the NDE. He noted that in the spirit world one no longer needs to eat food, but added that information takes its place as a source of nourishment™ He said that when spirits and angels talked, their thoughts were constantly coalescing into three dimensional symbolic images, especially animals. For example, he said that when angels talked about love and affection "beautiful animals are presented, such as lambs— When however the angels are talking about evil affections, this is portrayed by hideous, fierce, and useless animals, like tigers, bears, wolves, scorpions, snakes, and mice."[79] Although it is not a feature reported by modern NDEers, Swedenborg said that he was astonished to find that in heaven there are also spirits from other planets, an astounding assertion for a man who was born over three hundred years ago![80] Most intriguing of all are those remarks by Swedenborg that seem

to refer to reality's holographic qualities. For instance, he said that although human beings appear to be separate from one another, we are all connected in a cosmic unity. Moreover, each of us is a heaven in miniature, and every person, indeed the entire physical universe, is a microcosm of the greater divine reality. As we have seen, he also believed that underlying visible reality was a wave-substance.

In fact, several Swedenborg scholars have commented on the many parallels between some of Swedenborg's concepts and Bohm and Pribram's theory. One such scholar is Dr. George F. Dole, a professor of theology at the Swedenborg School of Religion in Newton, Massachusetts. Dole, who holds degrees from Yale, Oxford, and Harvard, notes that one of the most basic tenets of Swedenborg's thinking is that our universe is constantly created and sustained by two wavelike flows, one from heaven and one coming from our own soul or spirit. "If we put these images together, the resemblance to the hologram is striking," says Dole. "We are constituted by the intersection of two flows—one direct, from the divine, and one indirect, from the divine via our environment. We can view ourselves as interference patterns, because the inflow is a wave phenomenon, and we are where the waves meet."[81]

Swedenborg also believed that, despite its ghostlike and ephemeral qualities, heaven is actually a more fundamental level of reality than our own physical world. It is, he said, the archetypal source from whieh all earthly forms originate, and to which all forms return, a concept not too dissimilar from Bohm's idea of the implicate and explicate orders. In addition, he too believed that the afterlife realm and physical reality are different in degree but not in kind, and that the material world is just a frozen version of the thought-built reality of heaven. The matter that comprises both heaven and earth "flows in by stages" from the Divine, said Swedenborg, and "at each new stage it becomes more genera) and therefore coarser and hazier, and it becomes slower, and therefore more viscous and colder."[62]

Swedenborg filled almost twenty volumes with his experiences, and on his deathbed was asked if there was anything he wanted to recant. He earnestly replied: "Everything that I have written is as true as you now behold me. I might have said much more had it been permitted to me. After death you will see all, and then we shall have much to say to each other on the subject."[83]

The Land of Nonwhere

Swedenborg is not the only individual in history who possessed the ability to make out-of-body journeys to the subtler levels of reality. The twelfth-century Persian Sufis also employed deep trancelike meditation to visit the "land where spirits dwell." And again, the parallels between their reports and the body of evidence that has accrued in this chapter are striking. They claimed that in this other realm one possesses a "subtle body" and relies on senses that are not always associated with "specific organs" in that body. They asserted that it is a dimension populated by many spiritual teachers, or imams, and sometimes called it "the country of the hidden Imam."

They held that it is a world created solely out of the subtle matter of *alarn almithal,* or thought. Even space itself, including "nearness," "distances," and "far-off" places, was created by thought. But this did not mean that the country of the hidden Imam was unreal, a world constituted out of sheer nothingness. Nor was it a landscape created by only one mind. Rather it was a plane of existence *created by the imagination of many people,* and yet one that still had its own corporeality and dimension) its own forests, mountains, and even cities. The Sufis devoted a good deal of their writings to the clarification of this point So alien is this idea to many Western thinkers that the late Henry Corbin, a professor of Islamic Religion at the Sorbonne in Paris and a leading authority in Iranian-Islamic thought, coined the term *imaginal* to describe it, meaning a world that is created by imagination but is ontologically no less real than physical reality. "The reason I absolutely had to find another expression was that, for a good many years, my profession required me to interpret Arabic and Persian texts, whose meaning I would undoubtedly have betrayed had I simply contented myself with the term *imaginary,"* stated Corbin.[M]

Because of the imagina! nature of the afterlife realm, the Sufis concluded that *imagination itself is a faculty of perception,* an idea that offers new light on why Whitton's subject materialized a hand only after he started thinking, and why visualizing images has such a potent effect on the health and physical structure of our bodies. It also contributed to the Sufis' belief that one could use visualization, a process they called "creative prayer," to alter and reshape the very fabric of one's destiny.

In a notion that parallels Bohm's implicate and explicate orders, the Sufis believed that, despite its phantasmal qualities, the afterlife realm is the generative matrix that gives birth to the entire physical universe. All things in physical reality arise from this spiritual reality, said the Sufis. However, even the most learned among them found this strange, that by meditating and venturing deep into the psyche one arrived in an inner world that "turns out to envelop, surround, or contain that which at first was outer and visible."[85]

This realization is, of course, just another reference to the nonlocal and holographic qualities of reality. Each of us contains the whole of heaven. More than that, each of us contains the location of heaven. Or as the Sufis put it, instead of having to search for spiritual reality "in the where," the "where" is *in* us. Indeed, in discussing the nonlocal aspects of the afterlife realm, a twelfth-century Persian mystic named Sohrawardi said that the country of the hidden Imam might better be called *Na-Koja-Abad,* "the land of nonwhere."*[8]

Admittedly this idea is not new. It is the same sentiment expressed in the statement "the kingdom of heaven is within." What is new is the idea that such notions are actually references to the nonlocal aspects of the subtler levels of reality. Again, it is suggested that when a person has an OBE they might not actually travel anywhere. They might be merely altering the always illusory hologram of reality so that they have the experience of traveling somewhere. In a holographic universe not only is consciousness already everywhere, it too is nonwhere.

The idea that the afterlife realm lies deep in the nonlocal expanse of the psyche has been allude'd to by some NDEers. As one seven-year-old boy put it, "Death is like walking into your mind."[S7] Bohm offers a similarly nonlocal view of what happens during our transition from this life to the next: "At the present, our whole thought process is telling us that we have to keep our attention here. You can't cross the street, for example, if you don't. But consciousness is always in the unlimited depth which is beyond space and time, in the subtler levels of the implicate order. Therefore, if you went deeply enough into the actual present, then maybe there's no difference between this moment and the next. The idea would be that in the death experience you would get into that. Contact with eternity is in the present moment, but it is mediated by thought. It is a matter of attention."[88]

Intelligent and Coordinated Images of Light

The idea that the subtler levels of reality can be accessed through a shift in consciousness alone is also one of the main premises of the yogic tradition. Many yogic practices are designed specifically to teach individuals how to make such journeys. And once again, the individuals who succeed in these ventures describe what is by now a familiar landscape. One such individual was Sri Yukteswar Giri, a little known but widely respected Hindu holy man who died in Puri, India, in 1936. Evans-Wentz, who met Sri Yukteswar in the 1920s, described him as a man of "pleasing presence and high character" fully "worthy of the veneration that his followers accorded him."[69]

Sri Yukteswar appears to have been especially gifted at passing back and forth between this world and the next and described the afterlife dimension as a world composed of "various subtle vibrations of light and color" and "hundreds of times larger than the materia! cosmos." He also said that it was infinitely more beautiful than our own realm of existence, and abounded with "opal lakes, bright seas, and rainbow rivers." Because it is more "vibrant with God's creative light" its weather is always pleasant, and its only climatic manifestations are occasional falls of "luminous white snow and rain of many-colored lights."

Individuals who live in this wondrous realm can materialize any body they want and can "see" with any area of their body they wish. They can also materialize any fruit or other food they desire, although they "are almost freed from any necessity of eating" and "feast only on the ambrosia of eternally new knowledge."

They communicate through a telepathic series of "light pictures," rejoice at "the immortality of friendship," realize "the indestructibility of love," feel keen pain "if any mistake is made in conduct or perception of truth," and when they are confronted with the multitude of relatives, fathers, mothers, wives, husbands, and friends acquired during their "different incarnations on earth," they are at a loss as to whom to love especially and thus learn to give "a divine and equal love to all."

What is the quintessential nature of our reality once we take up residence in this luminous land? To this question, Sri Yukteswar gave an answer that was as simple as it was holographic. In this realm where eating and even breathing are unnecessary, where a single thought can materialize a "whole garden of fragrant flowers," and all

bodily injuries are "healed at once by mere willing," we are, quite simply, "intelligent and coordinated images of light."[90]

More References to Light

Sri Yukteswar is not the only yogic teacher to use such hologramlike terms when describing the subtler levels of reality. Another is Sri Aurobindo Ghose, a thinker, political activist, and mystic whom Indians revere alongside Gandhi. Born in 1872 to an upper-class Indian family, Sri Aurobindo was educated in England, where he quickly developed the reputation as a kind of prodigy. He was fluent not only in English, Hindi, Russian, German, and French, but also in ancient Sanskrit. He could read a case of books a day (as a youth he read all of the many and voluminous sacred books of India) and repeat verbatim every word on every page that he read. His powers of concentration were legendary, and it was said that he could sit studying in the same posture all night long, oblivious even to the incessant bites of the mosquitoes.

Like Gandhi, Sri Aurobindo was active in the nationalist movement in India and spent time in prison for sedition. However, despite all his intellectual and humanitarian passion, he remained an atheist until one day when he saw a wandering yogi instantaneously heal his brother of a life-threatening illness. From that point on Sri Aurobindo devoted his life to the yogic disciplines and, like Sri Yukteswar, through meditation he eventually learned to become, in his own words, "an explorer of the planes of consciousness."

It was not an easy task for Sri Aurobindo, and one of the most intractable obstacles he had to overcome to accomplish his goal was to learn how to silence the endless chatter of words and thoughts that flow unceasingly through the normal human mind. Anyone who has ever tried to empty his or her mind of *all* thought for even a moment or two knows how daunting an undertaking this is. But it is also a necessary one, for the yogic texts are quite explicit on this point. To plumb the subtler and more implicate regions of the psyche does indeed require a Bohmian shift of attention. Or as Sri Aurobindo put it, to discover the "new country within us" we must first learn how "to leave the old one behind."

It took Sri Aurobindo years to learn how to silence his mind and

travel inward, but once he succeeded he discovered the same vast territory encountered by all of the other Marco Polos of the spirit that we have looked at—a realm beyond space and time, composed of a "multicolored infinity of vibrations" and peopled by nonphysical beings so far in advance of human consciousness that they make us look like children. These beings can take on any form at will, said Sri Aurobindo, the same being appearing to a Christian as a Christian saint and to an Indian as a Hindu one, although he stressed that their purpose is not to deceive, but merely to make themselves more accessible "to a particular consciousness."

According to Sri Aurobindo, in their truest form these beings appear as "pure vibration." In his two-volume work, *On Yoga,* he even likens their ability to appear as either a form or a vibration, to the wave-particle duality discovered by "modern science." Sri Aurobindo also noted that in this luminous realm one is no longer restricted to taking in information in a "point-by-point" manner, but can absorb it "in great masses," and in a single glance perceive "large extensions of space and time."

In fact, quite a number of Sri Aurobindo's assertions are indistinguishable from many of Bohm's and Pribram's conclusions. He said that most human beings possess a "mental screen" that keeps us from seeing beyond "the veil of matter," but when one learns to peer beyond this veil one finds that everything is comprised of "different intensities of luminous vibrations." He asserted that consciousness is also composed of different vibrations and believed that all matter is to some degree conscious. Like Bohm, he even asserted that psychokinesis is a direct result of the fact that all matter is to some degree conscious. If matter were not conscious, no yogi could move an object with his mind because there would be no possibility of contact between the yogi and the object, Sri Aurobindo says.

Most Bohmian of all are Sri Aurobindo's remarks about wholeness and fragmentation. According to Sri Aurobindo, one of the most important things one learns in "the great and luminous kingdoms of the Spirit," is that all separateness is an illusion, and all things are ultimately interconnected and whole. Again and again in his writings he stressed this fact, and held that it was only as one descended from the higher vibrational levels of reality to the lower that a "progressive law of fragmentation" took over. We fragment things because we exist at a lower vibration of consciousness and reality, says Sri Aurobindo, and it is our propensity for fragmentation that keeps us from experiencing

the intensity of consciousness, joy, love, and delight for existence that are the norm in these higher and more subtle realms.

Just as Bohm believes that it is not possible for disorder to exist in a universe that is ultimately unbroken and whole, Sri Aurobindo believed the same was true of consciousness. If a single point of the universe were totally unconscious, the whole universe would be totally unconscious, he said, and if we perceive a pebble at the side of the road or a grain of sand under our fingernail to be lifeless and dead, our perception is again illusory and brought on only by our somnambulistic inurement with fragmentation.

Like Bohm, Sri Aurobindo's epiphanic understanding of wholeness also made him aware of the ultimate relativity of all truths and the arbitrariness of trying to divide the seamless holomovement up into "things." So convinced was he that any attempt to reduce the universe into absolute facts and unchangeable doctrine only led to distortion that he was even against religion, and all his life emphasized that the true spirituality came not from any organization or priesthood, but from the spiritual universe within:

> We must not only cut asunder the snare of the mind and the senses, but flee also from the snare of the thinker, the snare of the theologian and the church-builder, the meshes of the Word and the bondage of the Idea. All these are within us waiting to wall in the spirit with forms; but we must always go beyond, always renounce the lesser for the greater, the finite for the Infinite; we must be prepared to proceed from illumination to illumination, from experience to experience, from soul-state to soul-state__ Nor must we attach ourselves even to the truths we hold most securely, for they are but forms and expressions of the Ineffable who refuses to limit itself to any form or expression."[1]

But if the cosmos is ultimately ineffable, a farrago of multicolored vibrations, what are all the forms we perceive? What is physical reality? It is, said Sri Aurobindo, just "a mass of stable light."[92]

Survival in Infinity

The picture of reality reported by NDEers is remarkably self-consistent and is corroborated by the testimony of many of the world's most

talented mystics as well. Even more astonishing is that as breathtaking and foreign as these subtler levels of reality are to those of us who reside in the world's more "advanced" cultures, they are mundane and familiar territories to so-called primitive peoples.

For example, Dr. E. Nandisvara Nayake Thero, an anthropologist who has lived with and studied a community of aborigines in Australia, points out that the aboriginal concept of the "dreamtime," a realm that Australian shamans visit by entering a profound trance, is almost identical to the afterlife planes of existence described in Western sources. It is the realm where human spirits go after death, and once there a shaman can converse with the dead and instantly access all knowledge. It is also a dimension in which time, space, and the other boundaries of earthly life cease to exist and one must learn to deal with infinity. Because of this, Australian shamans often refer to the afterlife as "survival in infinity."[311]

Holger Kaiweit, a German ethnopsychologist with degrees in both psychology and cultural anthropology, goes Thero one better. An expert on shamanism who is also active in near-death research, Kaiweit points out that virtually *all* of the world's shamanic traditions contain descriptions of this vast and extradimensional realm, replete with references to the life review, higher spiritual beings who teach and guide, food conjured up out of thought, and indescribably beautiful meadows, forests, and mountains. Indeed, not only is the ability to travel into the afterlife realm the most universal requirement for being a shaman, but NDEs are often the very catalyst that thrusts an individual into the role. For instance, the Oglala Sioux, the Seneca, the Siberian Yakut, the South American Guajiro, the Zulu, the Kenyan Kikuyu, the Korean Mu dang, the Indonesian Mentawai Islanders, and the Caribou Eskimo—all have traditions of individuals who became shamans after a life-threatening illness propelled them headlong into the afterlife realm.

However, unlike Western NDEers for whom such experiences are disorientingly new, these shamanic explorers appear to have a far vaster knowledge of the geography of these subtler realms and are often able to return to them again and again. Why? Kaiweit believes it is because such experiences are a daily reality for such cultures. Whereas our society suppresses any thoughts or mention of death and dying, and has devalued the mystical by defining reality strictly in terms of the material, tribal peoples still have day-to-day contact with the psychic nature of reality. Thus, they have a better understanding

of the rules that govern these inner realms, says Kaiweit, and are much more skilled at navigating their territories.[94]

That these inner regions have been well traveled by shamanic peoples is evidenced by an experience anthropologist Michael Harner had among the Conibo Indians of the Peruvian Amazon. In 1960 the American Museum of Natural History sent Harner on a year-long expedition to study the Conibo, and while there he asked the Amazonian natives to tell him about their religious beliefs. They told him that if he really wished to learn, he had to take a shamanic sacred drink made from a hallucinogenic plant known as *ayakuasca,* the "soul vine." He agreed and after drinking the bitter concoction had an out-of-body experience in which he traveled a level of reality populated by what appeared to be the gods and devils of the Conibo's mythology. He saw demons with grinning crocodilian heads. He watched as an "energy-essence" rose up out of his chest and floated toward a dragon-headed ship manned by Egypti an-style figures with blue-jay heads; and he felt what he thought was the slow, advancing numbness of his own death.

But the most dramatic experience he had during his spirit journey was an encounter with a group of winged, dragonlike beings that emerged from his spine. After they had crawled out of his body, they "projected" a visual scene in front of him in which they showed him what they said was the "true" history of the earth. Through a kind of "thought language" they explained that they were responsible for both the origin and evolution of all life on the planet. Indeed, they resided not only in human beings, but in all life, and had created the multitude of living forms that populates the earth to provide themselves with a hiding place from some undisclosed enemy in outer space (Harner notes that although the beings were almost like DNA, at the time, 1961, he knew nothing of DNA).

After this concatenation of visions was over, Harner sought out a blind Conibo shaman noted for his paranormal talents to talk to him about the experience. The shaman, who had made many excursions into the spirit world, nodded occasionally as Harner related the events that had befallen him, but when he told the old man about the dragonlike beings and their claim that they were the true masters of the earth, the shaman smiled with amusement. "Oh, they!re always saying that. But they are only the Masters of Outer Darkness," he corrected.

"I was stunned," says Harner. "What I had experienced was already familiar to this barefoot, blind shaman. Known to him from his

own explorations of the same hidden world into which I had ventured." However, this was not the only shock Harner received. He also recounted his experience to two Christian missionaries who lived nearby, and was intrigued when they too seemed to know what he was talking about. After he finished they told him that some of his descriptions were virtually identical to certain passages in the Book of Revelation, passages that Harner, an atheist, had never read.[95] So it seems that the old Conibo shaman perhaps was not the only individual to have traveled the same ground Harner later and more falteringly covered. Some of the visions and "trips to heaven" described by Old and New Testament prophets may also have been shamanic journeys into the inner realm.

Is it possible that what we have been viewing as quaint folklore and charming but naive mythology are actually sophisticated accounts of the cartography of the subtler levels of reality? Kalweit for one believes the answer is an emphatic yes, "In light of the revolutionary findings of recent research into the nature of dying and death, we can no longer look upon tribal religions and their ideas about the World of the Dead as limited conceptions," he says, "[Rather] the shaman should be considered as a most up-to-date and knowledgeable psychologist."[96]

An Undeniable Spiritual Radiance

One last piece of evidence of the reality of the NDE is the transformative effect it has on those who experience it. Researchers have discovered that NDEers are almost always profoundly changed by their journey to the beyond. They become happier, more optimistic, more easygoing, and less concerned with material possessions. Most striking of all, their capacity to love expands enormously. Aloof husbands suddenly become warm and affectionate, workaholics start relaxing and devoting time to their families, and introverts become extroverts. These changes are often so dramatic that people who know the NDEer frequently remark that he or she has become an entirely different person. There are even cases on record of criminals completely reforming their ways, and fire-and-brimstone preachers replacing their message of damnation with one of unconditional love and compassion-

NDEers also become much more spiritually oriented. They return not only firmly convinced of the immortality of the human soul, but also with a deep and abiding sense that the universe is compassionate and intelligent, and this loving presence is always with them. However, this awareness does not necessarily result in their becoming more religious. Like Sri Aurobindo, many NDEers stress the importance of the distinction between religion and spirituality, and assert that it is the latter that has blossomed into greater fullness in their lives, not the former. Indeed, studies show that following their experience, NDEers display an increased openness to ideas outside their own religious background, such as reincarnation and Eastern religions.[97]

This widening of interests frequently extends to other areas as well. For instance, NDEers often develop a marked fascination for the types of subjects discussed in this book, in particular psychic phenomena and the new physics. One NDEer investigated by Ring, for example, was a driver of heavy equipment who displayed no interest in books or academic pursuits prior to his experience. However, during his NDE he had a vision of total knowledge, and although he was unable to recall the content of the vision after he recovered, various physics' terms started popping into his head. One morning not long after his experience he blurted out the word *quantum*. Later he announced cryptically, "Max Planck—you'll be hearing about him in the near future," and as time continued to pass, fragments of equations and mathematical symbols began to surface in his thoughts.

Neither he nor his wife knew what the word *quantum* meant, or who Max Planck {widely viewed as the founding father of quantum physics) was until the man went to a library and looked the words up. But after discovering that he was not talking gibberish, he started to read voraciously, not only books on physics, but also on parapsychology, metaphysics, and higher consciousness; and he even enrolled in college as a physics major. The man's wife wrote a letter to Ring trying to describe her husband's transformation:

> Many times he says a word he has never heard before in our reality—it might be a foreign word of a different language—-but learns ... it in relationship to the "light" theory. … He talks about things faster than the speed of light and it's hard for me to understand— When [he] picks up a book on physics he already knows the answer and seems to feel more. , . ,[3(l]

The man also started developing various psychic abilities after his experience, which is not uncommon among NDEers. In 1982 Bruce Greyson, a psychiatrist at the University of Michigan and IANDS's director of research, gave sixty-nine NDEers a questionnaire designed to study this issue, and he found that there was an increase in virtually all of the psychic and psi-related phenomena he assessed." Phyllis Atwater, an Idaho housewife who became an NDE researcher following her own transformative NDE, has interviewed dozens of NDEers and has obtained similar findings. "Telepathy and healing gifts are common," she states. "So is 'remembering' the future. Time and space stop, and you live in a future sequence in detail. Then, when the event occurs, you recognize it."[100]

Moody believes that the profound and positive identity changes such individuals undergo is the most compelling evidence that NDEs are actually journeys into some spiritual level of reality. Ring agrees. "[At the core of the NDE] we find an absolute and undeniable spiritual radiance," he says. "This spiritual core is so awesome and overwhelming that the person is at once and forever thrust into an entirely new mode of being."[101]

NDE researchers are not the only individuals who are beginning to accept the existence of this dimension and the spiritual component of the human race. Nobelist Brian Josephson, himself a longtime meditator, is also convinced that there are subtler levels of reality, levels that can be accessed through meditation and where, quite possibly, one travels after death.[303]

At a 1985 symposium on the possibility of life beyond biological death held at Georgetown University and convened by U.S. Senator Claiborne Pell, physicist Paul Davies expressed a similar openness. "We are all agreed that, at least insofar as human beings are concerned, mind is a product of matter, or put more accurately, mind finds expression through matter (specifically our brains). The lesson of the quantum is that matter can only achieve concrete, well-defined existence in conjunction with mind. Clearly, if mind is *pattern* rather than *substance,* then it is capable of many different representations."[05]

Even psychoneuroimmunologist Candace Pert, another participant at the symposium, was receptive to the idea. "I think it is important to realize that information is stored in the brain, and it is conceivable to me that this information could transform itself into some other realm. Where does the information go after the destruction of the molecules (the mass) that compose it? Matter can neither be created

nor destroyed, and perhaps biological information flow cannot just disappear at death and must be transformed into another realm," she says.""

Is it possible that what Bohm has called the implicate level of reality is actually the realm of the spirit, the source of the spiritual radiance that has transfigured the mystics of all ages? Bohm himself does not dismiss the idea. The implicate domain "could equally well be called Idealism, Spirit, Consciousness," he states with typical matter-of-fact-ness. "The separation of the two—matter and spirit—is an abstraction. The ground is always one."[10]*

Who Are the Beings of Light?

Because most of the above remarks were made by physicists and not theologians, one cannot help but wonder if perhaps the interest in new physics displayed by Ring's NDEer is an indication of something deeper. If, as Bohm suggests, physics is beginning to make inroads in areas that were once exclusively the province of the mystic, is it possible that these encroachments have already been anticipated by the beings who inhabit the near-death realm? Is that why NDEers are given an insatiable hunger for such knowledge? Are they, and by proxy the rest of the human race, being prepared for some coming confluence between science and the spiritual?

We will explore this possibility a little later. First, another question must be asked. If the existence of this higher dimension is no longer at issue, then what are its parameters? More specifically, who are the beings that inhabit it, and what is their society, dare one say their civilization, really like?

These are, of course, difficult questions to answer. When Whitton tried to find out the identity of the beings who counseled people in the between-life state, he found the answer elusive. "The impression my subjects gave—the ones who could answer the question—was that these were entities who had completed their cycle of incarnations here," he says.[106]

After hundreds of journeys into the inner realm, and after interviewing dozens of other talented fellow OBEers on the matter, Monroe has also come up empty-handed. "Whatever they may be, [these beings] have the ability to radiate a warmth of friendliness that

evokes complete trust," he observes, "Perceiving our thoughts is absurdly easy for [them]." And "the entire history of humankind and earth is available to them in the most minute detail." But Monroe, too, confesses ignorance when it comes to the ultimate identity of these nonphysical entities, save that their first order of business appears to ^ be "totally solicitous as to the well-being of the human beings with whom they are associated."[107]

Not *muck* more can be said about the civilizations of these subtle realms, save that individuals who are privileged enough to visit them universally report seeing many vast and celestially beautiful cities there. NDEers, yogic adepts, and *ayahuasca*-using shamans—all describe these mysterious metropolises with remarkable consistency. The twelfth-century Sufis were so familiar with them that they even gave several of them names.

The most notable feature of these great cities is that they are brilliantly luminous. They are also frequently described as foreign in architecture, and so sublimely beautiful that, like all of the other features of these implicate dimensions, words fail to convey their grandeur. In describing one such city Swedenborg said that it was a place "of staggering architectural design, so beautiful that you would say this is the home and the source of the art itself."[108]

People who visit these cities also frequently assert that they have an unusual number of schools and other buildings associated with the pursuit of knowledge. Most of Whitton's subjects recalled spending at least some time hard at work in vast halls of learning equipped with libraries and seminar rooms while in the between-life state.[109] Many NDEers also report being shown "schools," "libraries," and "institutions of higher learning" during their experiences.[110] And one can even find references to great cities devoted to learning and reachable only by journeying into "the hidden depths of the mind" in eleventh-century Tibetan texts. Edwin Bernbaum, a Sanskrit scholar at the University of California at Berkeley, believes that James Hilton's novel *Lost Horizon,* in which he created the fictional community of Shangri-La, was actually inspired by one of these Tibetan legends.'''

"Throughout my high-school and college years 1 had vivid and frequent dreams that I was attending classes on spiritual subjects at a strangely beautiful university in some sublime and otherworldly place. These were not anxiety dreams about going to school, but incredibly pleasant flying dreams in which I floated weightlessly to lectures on the human energy field and reincarnation. During these dreams 1 sometimes encountered people I had known in this life but who had died, and even people who identified themselves aa souls about to be reborn.

The only problem is that in an imaginal realm such descriptions don't mean very much. One can never be sure whether the spectacular architectural structures NDEers encounter are realities or just allegorical phantasms. For instance, both Moody and Ring have reported cases in which NDEers said that the buildings of higher learning they visited were not just devoted to knowledge, but were literally *built out of* knowledge."[2] This curious choice of words suggests that perhaps visits to these edifices are actually encounters with something so beyond human conception—perhaps a dynamic living cloud of pure knowledge, or what information becomes, as Pert puts it, after it has been *transformed into another realm*—that translating it into a hologram of a building or library is the only way the human mind can process it

The same is true of the beings one encounters in the subtler dimensions. We can never know from their appearance alone what they really are. For example, George Russell, a well-known turn-of-the-century Irish seer and an extraordinarily talented OBEer, encountered many "beings of light" during what he called his journeys into the "inner world." When asked once during an interview to describe what these beings looked like he stated:

> The first of these I saw I remember very clearly, and the manner of its appearance: mere was at first a dazale of light, and then 1 saw that this came from the heart of a tall figure with a body apparently shaped out of half-transparent or opalescent air, and throughout the body ran a radiant, electrical fire, to which the heart seemed the centre. Around the head of this being and through its waving luminous hair, which was blown all about the body like living strands of gold, there appeared naming wing-like auras. From the being itself light seemed to stream outwards in every direction; and the effect left on me after the vision was one of extraordinary lightness, joyousness, or ecstasy.[113]

Intriguingly, I have met several other individuals, usually people with more than normal psychic ability, who have also had these dreams (one, a talented Texas clairvoyant named Jim Gordon, was so baffled by the experience that he often asked his nonplussed mother why he had to go to school *twice,* once during the day with all the other children, and once at night while he slept). Tt is relevant to mention here that Monroe and numerous other OBE researchers believe that flying dreams are actually just poorly remembered OBEs. making me wonder if perhaps some of us, at least, are visiting these incorporeal schools even while we are alive. If anyone reading this book has also had such experiences. I would be very interested in hearing about them.

On the other hand, Monroe asserts that once he has been in the presence of one of these nonphysical entities for a while, it discards !L aP^ranC J- ht PercdveS nothing, a]thou eh he continues to

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asked When a journeyer to the inner dimensions encounters a being 01 light, a that being a reality or just an allegorical phantasm? The answer is, of course, that it is a bit of both, for in a holographic ZTIh"' appeaTMces *" i]lusions, hologramlike images con-hS I ,! mteract!ra of the consciousness present, but illusions oased, as Pribram says, on *something* that is there. Such are the h! t1iT 1 1 ka "niVerSe ** appears t0 us in exPlica* form but always has its source in something ineffable, in the implicate

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The Omnijective Universe

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occasion we can even have such experiences at our own level of existence. For example, philosopher Michael Grosso believes that miraculous appearances of the Virgin Mary may also be hologramlike projections created by the collective beliefs of the human race. One "Marian" vision that is especially holographic in flavor is the well-known appearance of the Virgin in Knock, Ireland, in 1879. On that occasion fourteen people saw three glowing and eerily motionless figures consisting of Mary, Joseph, and St John the Evangelist (identified because he closely resembled a statue of the saint in a nearby village) standing in a meadow next to the local church. These brilliantly luminous figures were so real that when witnesses approached, they could even read the lettering on a book St. John was holding. But when one of the women present tried to embrace the Virgin, her arms closed on empty air. "The figures appeared so full and lifelike I could not understand why my hands could not feel what was so plain and distinct to my sight," the woman later wrote.[115]

Another impressively holographic Marian vision is the equally famous appearance of the Virgin in Zeitoun, Egypt. The sightings began in 1968 when two Moslem automobile mechanics saw a luminous apparition of Mary standing on the ledge of the central dome of a Coptic church in the poor Cairo suburb. For the next three years glowing three-dimensional images of Mary, Joseph, and the Christ Child appeared weekly over the church, sometimes hovering in midair for as long as six hours.

Unlike the figures at Knock, the Zeitoun apparitions moved about and waved at the crowds of people who regularly gathered to see them. However, they too had many holographic aspects. Their appearance was always heralded by a brilliant flash of light. Like holograms shifting from their frequency aspects and slowly coming into focus, they were at first amorphous and slowly coalesced into human shape. They were often accompanied by doves "formed of pure light" that soared for great distances over the crowd, but never flapped their wings. Most telling of all, after three years of manifestations and as interest in the phenomenon started to wane, the Zeitoun figures also waned, becoming hazier and hazier until, in their last several appearances, they were little more than clouds of luminous fog. Nonetheless, during their peak, the figures were seen by literally hundreds of thousands of witnesses and were extensively photographed. "I've interviewed quite a number of these people, and when you hear them talk about what they saw you can't get rid of the feeling that they're

describing some sort of holographic projection," says Grosso.[11]*

In his tiought-provoking book *The Final Choice,* Grosso says that after stucying the evidence he is convinced that such visions are not appearances of the historical Mary, but are actually psychic holographic projections created by the collective unconscious. Interestingly, notall of the Marian apparitions are silent. Some, like the manifestations at Fatima and Lourdes, speak, and when they do their message s invariably a warning of impending apocalypse if we mortals do no[1], mend our ways. Grosso interprets this as evidence that the human collective unconscious is deeply disturbed by the violent impact modern science has had on human life and on the ecology of the earth. Our collective dreams are, in essence, warning us of the possibility of our own self-destruction.

Others nave also agreed that belief in Mary is the motivating force that causes these projections to coalesce into being. For instance, Rogo points out that in 1925, while the Coptic church that became the site of tht Zeitoun manifestations was being built, the philanthropist responsible for its construction had a dream in which the Virgin told him she would appear at the church as soon as it was completed. She did not appear at the prescribed time, but the prophecy was well known in the community. Thus *"there existed a forty-year-old tradition that a Marian visitation would eventually take place at the church,"* says Rogo. 'These preoccupations may have gradually built up a psychic 'blueprint' of the Virgin within the church itself, i.e., an ever-increasing pool of psychic energy created by the thoughts of the Zeitouniaris which in 1968 became so high-pitched that an image of the Virgin Mary burst into physical reality!"[117] In previous writings I, too, have offered a similar explanation of Marian visions.[118]

There is evidence that some UFOs may also be some kind of hologramlike phenomenon. When people first started reporting sightings of what appeared to be spacecraft from other planets in the late 1940s, researchers who delved deeply enough into the reports to realize that at least some of them had to be taken seriously assumed that they were exactly what they appeared to be—glimpses of intelligently guided crafts from more advanced and probably extraterrestrial civilizations. However, as encounters with UFOs become more widespread—especially those involving contact with UFO occupants—and data accumulates, it becomes increasingly apparent to many researchers that these so-called spacecraft are *not* extraterrestrial in origin.

Some of the features of the phenomenon that indicate they are not

extraterrestrial include the following: First, there are too many sightings; literally thousands of encounters with UFOs and their occupants have been documented, so many that it is difficult to believe they could all be actual visits from other planets. Second, UFO occupants often do not possess traits one would expect in a truly extraterrestrial Hfeform; too many of them are described as humanoid beings who breathe our air, display no fear of contracting earthly viruses, are well adapted to the earth's gravity and the sun's electromagnetic emissions, display recognizable emotions in their faces, and talk our language—all of which are possible but unlikely traits in truly extraterrestrial visitors.

Third, they do not behave as extraterrestrial visitors. Instead of making the proverbial landing on the White House lawn, they appear to farmers and stranded motorists. They chase jets but don't attack. They dart around in the sky allowing dozens and sometimes hundreds of witnesses to see them, but they show no interest in making any formal contact. And often, when they contact individuals their behavior still seems illogical. For instance, one of the most commonly reported types of contact is that which involve some sort of medical examination. And yet, arguably, a civilization that possesses the technological capability to travel almost incomprehensible tracts of outer space would most assuredly possess the scientific wherewithal to obtain such information without any physical contact at alt or, at the very least, without having to abduct the scores of people who appear to be legitimate victims of this mysterious phenomenon.

Finally, and most curious of all, UFOs do not even behave as physical objects do. They have been watched on radar screens to make instant ninety-degree-angle turns while traveling at enormous speeds—an antic that would rip a physical object apart They can change size, instantly vanish into nothingness, appear out of nowhere, change color, and even change shape (traits that are also displayed by their occupants). *In* short, their behavior is not at all what one would expect from a physical object, but of something quite different, something with which we have become more than a little familiar in this book. As astrophysicist Dr. Jacques Vallee, one of the world's most respected UFO researchers and the model for the character LaCombe in the film *Close Encounters of the Third Kind,* stated recently, "It is the behavior of an image, or a holographic projection."[11]*

As the nonphysical and hologramlike qualities of UFOs become increasingly apparent to researchers, some have concluded that rather

than being from other star systems, UFOs are actually visitors from other dimensions, or levels of reality (it is important to note that not all researchers agree with this point of view, and some remain convinced that UFOs are extraterrestrial in origin). However, this explanation still does not adequately explain many of the other bizarre aspects of the phenomenon, such as why UFOs aren't making formal contact, why they behave so absurdly, and so on.

Indeed, the inadequacy of the *extra* dimensional explanation, at least in the terms in which it was initially couched, only becomes more glaring as still further unusual aspects of the UFO phenomenon come into focus. One of the more baffling of these is growing evidence that UFO encounters are less of an objective experience and more of a subjective, or psychological, one. For instance, the well-known "interrupted journey" of Betty and Barney Hill, one of the most thoroughly documented UFO abduction cases on record, seems as if it were an actual alien contact in all ways except one: the commander of the UFO was dressed in a Nazi uniform, a fact that does not make sense if the Hills' abductors were truly visitors from an alien civilization, but it does if the event was psychological in nature and more akin to a dream or hallucination, experiences that often contain obvious symbols and disconcerting flaws in logic.[120]

Other UFO encounters are even more surreal and dreamlike in character, and in the literature one can find cases in which UFO entities sing absurd songs or throw strange objects (such as potatoes) at witnesses; cases that start out as straightforward abductions aboard spacecraft but end up as hallucinogenic journeys through a series of Dantesque realities; and cases in which humanoid aliens shapeshift into birds, giant insects, and other phantasmagoric creatures.

As early as 1959, and even before much of this evidence was in, the psychological and archetypal component of the UFO phenomenon inspired Carl Jung to propose that "flying saucers" were actually a product of the collective human unconscious and a kind of modern myth in the making. In 1969, and as the mythic dimension of UFO experiences became even clearer, Vallee took the observation a step further. In his landmark book *Passport to Magonia* he points out that, far from being a new phenomenon, UFOs actually appear to be a very old phenomenon in a new guise and greatly resemble various folkloric traditions, from descriptions of elves and gnomes in European countries to medieval accounts of angels to the supernatural beings described in Native American legends.

The absurd behavior of UFO entities is the same as the mischievous behavior of elves and fairies in Celtic legends, the Norse gods, and the trickster figures among the Native Americans, says Vallee. When stripped to their underlying archetypes, all such phenomena are part of the same vast, pulsating something, a something that changes its appearance to suit the culture and time period in which it manifests, but that has been with the human race for a long, long time. What is that something? In *Passport to Magonia* Vallee provides no substantive answer and says only that it appears to be intelligent, timeless, and to be the phenomenon on which all myths are based.[12']

What, then, are UFOs and related phenomena? In *Passport to Magonia* Vallee says that we cannot rule out the possibility that they are the expression of some extraordinarily advanced nonhuman intelligence, an intelligence so beyond us that its logic appears to us only as absurdity. But if this is true, how are we to explain the conclusions of mythology experts from Mircea Eliade to Joseph Campbell that myths are an organic and necessary expression of the human race, as inevitable a human by-product as language and art? Can we really accept that the collective human psyche is so barren and jejune that it developed myths only as a response to another intelligence?

And yet, if UFOs and related phenomena are merely psychic projections, how are we to explain the physical traces they leave behind, the burnt circles and deep impressions found at the sites of landings, the unmistakable tracks they make on radar screens, and the scars and incision marks they leave on the people on whom they perform their medical examinations? In an article published in 1976,1 proposed that such phenomena are difficult to categorize because we are trying to hammer them into a picture of reality that is fundamentally incorrect, [lii] Given that quantum physics has shown us that mind and matter are inextricably linked, I suggested that UFOs and related phenomena are further evidence of this ultimate lack of division between the psychological and physical worlds. They are indeed a product of the collective human psyche, *but they are also quite real.* Put another way, they are something the human race has not yet learned to comprehend properly, a phenomenon that is neither subjective nor objective but "omnijective"—a term I coined to refer to this unusual state of existence (I was unaware at the time that Corbin had already coined the term *imaginal* to describe the same blurred status of reality, only in the context of the mystical experiences of the Sufis). This point of view has become increasingly prevalent among re-

searchers. In a recent article Ring argues that UFO encounters are imaginal experiences and are similar not only to the confrontations with the real but mind-created world individuals experience during NDEs, but also to the mythic realities shamans encounter during journeys through the subtler dimensions. They are, in short, further evidence that reality is a multilayered and mind-generated hologram.[123]

"I'm finding that I'm drawn more and more to points of view that allow me not only to acknowledge and honor the reality of these different experiences, but also to see the connections between realms that, for the most part, have been studied by different categories of scholars," states Ring. "Shamanism tends to be thrown into anthropology. UFOs tend to be thrown into whatever ufology is. NDEs are studied by parapsychologists and medical people. And Stan Grof studies psychedelic experiences from a transpersonai psychology perspective. I think there's good reason to hope that the imaginal can be, and the holographic might still prove to be, perspectives that can allow one to see not the identities, but the linkages and commonalities between these different types of experiences."[1^] So convinced is Ring of the profound relationship among these at first seemingly disparate phenomena that he has recently obtained a grant to do a comparative study on people who have had UFO encounters and people who have had NDEs.

Dr. Peter 51 Rojcewicz, a folklorist at the Juilliard School in New York City, has also concluded that UFOs are omnijective. In fact, he believes the time has come for folklorists to realize that probably all of the phenomena discussed by Vallee in *Passport to Magonia* are as real as they are symbolic of processes deep in the human psyche. "There exists a continuum of experiences where reality and imagination imperceptibly flow into each other," he states. Rojcewicz acknowledges that this continuum is further evidence of the Bohmian unity of all things and feels that, in tight of the evidence that such phenomena are imaginal/omnijective, it is no longer defensible for folklorists to treat them simply as beliefs.[125]

Numerous other researchers, including Vallee, Grosso, and Whitley Strieber, author of the bestselling book *Communion* and one of the most famous and articulate victims of a UFO abduction, have also acknowledged the seeming omnijective nature of the phenomenon. As Strieber states, encounters with UFO beings "may *be* our first true quantum discovery in the large-scale world: The very act of observing

it may be creating it as a concrete actuality, with sense, definition, and a consciousness of its own."[126]

In short, there is growing agreement among researchers of this mysterious phenomenon that the imaginal is not confined to the afterlife realm, but has spilled over into the seeming solidity of our sticks-and-stones world. No longer confined to the visions of shamans, the old gods have sailed their celestial barks right up to the doorstep of the computer generation, only instead of dragon-headed ships their vessels are spaceships, and they have traded in their blue-jay heads for space helmets. Perhaps we should have anticipated this spillover long ago, this merging of the Land of the Dead with our own realm, for as Orpheus, the poet-musician of Greek mythology, once warned, "The gates of Pluto must not be unlocked, within is a people of dreams."

As significant as this realization is—that the universe is not objective but omnijective, that just beyond the pale of our own safe neighborhood lies a vast otherness, a numinous landscape (more properly a mindscape) as much a part of our own psyche as it is terra incognita—it still does not shed light on the deepest mystery of all. As Carl Raschke, a faculty member in the Department of Religious Studies at the University of Denver, notes, "In the omnijective cosmos, where UFOs have their place alongside quasars and salamanders, the issue of the veridical, or hallucinatory, status of glowing, circular appari- -tions, becomes moot. The problem is *not* whether they exist, or in what sense they exist, but what ultimate aim they serve."[127]

In other words, what is the final identity of these beings? Again, as with entities encountered in the near-death realm, there are no clear-cut answers. On one end of the spectrum, researchers such as Ring and Grosso lean toward the idea that, despite their impingements in the world of matter, they are more psychic projection than nonhuman intelligence. Grosso, for instance, thinks that, like Marian visions, they are further evidence that the psyche of the human race is in a state of unrest. As he states, "UFOs and other extraordinary phenomena are manifestations of a disturbance in the collective unconscious of the human species."[128]

On the other end of the spectrum are those researchers who maintain that, despite their archetypal characteristics, UFOs are more alien intelligence than psychic projection. For example, Raschke believes that UFOs are "a holographic materialization from a conjugate dimension of the universe" and that this interpretation "certainly must take precedence over the psychic projection hypothesis, which flounders

when one examines thoughtfully the astounding, vivid, complex, and consistent features of the 'aliens' and their 'spaceships' described by abductees."[129]

Vallee is also in this camp: "I believe that the UFO phenomenon is one of the ways through which an alien form of intelligence of incredible complexity is communicating with us *symbolically.* There is no indication that it is extraterrestrial. Instead, there is mounting evidence that it. .. [comes from] *other dimensions beyond spacetime;* from a *multiverse* which is all around us, and of which we have stubbornly refused to consider in spite of the evidence available to us for centuries."[130]

As for my own feelings, I believe that probably no single explanation can account for all of the varied aspects of the UFO phenomenon. Given the apparent vastness of the subtler levels of reality, it is easy for me to believe that there are no doubt countless nonphysical species in the higher vibratory realms. Although the abundance of UFO sightings may bode against their being extraterrestrial—given the obstacle posed by the immense interstellar distances separating the Earth from the other stars in the galaxy—in a holographic universe, a universe in which there may be an infinity of realities occupying the same space as our own world, it ceases not only to be a sticking point, but may in fact be evidence of just how unfathomably abundant with intelligent life the superhologram is.

The truth is that we simply do not have the information necessary to assess how many nonphysical species are sharing our own space. Although the physical cosmos may turn out to be an ecological Sahara, the spaceless and timeless expanses of the inner cosmos may be as rich with life as the rain forest and the coral reef. After all, research into NDEs and shamanic experiences has so far taken us only just inside the borders of this cloud-shrouded realm. We do not yet know how large its continents are or how many oceans and mountain ranges it contains.

And if we are being visited by beings who are as insubstantial and plastic in form as the bodies OBEers find themselves in after they have exteriorized, it is not at all surprising that they might appear in a chameieonlike multitude of shapes. In fact, their actual appearance may be so beyond our comprehension that it may be our own hoU> graphically organized minds that give them these shapes. Just as we convert the beings of light encountered during NDEs into religious historical personages, and clouds of pure information into libraries

and institutions of learning, our minds may also be sculpting the outward appearance of the UFO phenomenon.

It is interesting to note that if this is the case, it means that the true reality of these beings is apparently so transmundane and strange that we have to plumb the deepest regions of our folk memories and mythological unconscious to find the necessary symbols to give them form. It also means that we must be exceedingly careful in interpreting their actions. For example, the medical examinations that are the centerpiece of so many UFO abductions may be only a *symbolic* representation of what is going on. Rather than probing our physical bodies, these nonphysical intelligences actually may be probing some portion of us for which we currently have no labels, perhaps the subtle anatomy of our energy selves or even our very souls. Such are the problems one faces if the phenomenon is indeed an omnijective manifestation of a nonhuman intelligence.

On the other hand, if it is possible for the faith of the citizens of Knock and Zeitoun to cause luminous images of the Virgin to coalesce into existence, for the minds of physicists to dabble around with the reality of the neutrino, and for yogis such as Sai Baba to materialize physical objeets out of thin air, it only stands to reason that we would also find ourselves awash with holographic projections of our beliefs and mythologies. At least some anomalous experiences may fall into this category.

For instance, history tells us that Constantine and his soldiers saw an enormous flaming cross in the sky, a phenomenon that seems to be nothing more than a psychic exteriorization of the emotions the army responsible for nothing short of the Christianization of the pagan world was feeling on the eve of their historic undertaking. The well-known manifestation of the Angels of Mons, in which hundreds of World War I British soldiers saw an immense apparition of Saint George and a squadron of angels in the sky while fighting what was at first a losing battle at the front, in Mons, Belgium, also appears to fall into the category of psychic projection.

It is clear to me that what we are calling UFO and other folkloric experiences are really a wide range of phenomena and probably include all of the above. I have also long been of the opinion that these two explanations are not mutually exclusive. It may be that Constan^ tine's flaming cross was also a manifestation of an extradimensiona) intelligence. In other words, when our collective beliefs and emotions become high-pitched enough to create a psychic projection, perhaps

what we are really doing is opening a doorway between this world and the next. Perhaps the only time these intelligences can appear and interact with us is when our own potent beliefs create a kind of psychic niche for them.

Another concept from the new physics may be relevant here. After acknowledging that consciousness is the agent that allows a subatomic particle such as an electron to pop into existence, we should not therefore jump to the conclusion that we are the sole agents in this creative process, cautions University of Texas physicist John Wheeler. We are creating subatomic particles and hence the entire universe, says Wheeler, but they are also creating us. Each creates the other in what he calls a "self-reference cosmology."[131] Seen in this light, UFO entities may very well be archetypes from the collective unconscious of the human race, but we may also be archetypes in their collective unconscious. We may be as much a part of their deep psychic processes as they are of ours. Strieber has also echoed this point and says that the universe of the beings who abducted him and our own are "spinning each other together" in an act of cosmic communion.[132]

The spectrum of events we are lumping into the broad category of UFO encounters may also include phenomena with which we are not even yet familiar. For instance, researchers who believe the phenomenon is some kind of psychic projection invariably assume that it is a projection of the collective human mind. However, as we have seen in this book, in a holographic universe we can no longer view consciousness as confined solely to the brain. The fact that Carol Dryer was able to communicate with my spleen and tell me that it was upset because I had yelled at it indicates that other organs in our body also possess their own unique forms of mentality. Psychoneuroimmunologists say the same about the cells in our immune system, and according to Bohm and other physicists, even subatomic particles possess this trait. As outlandish as it sounds, some aspects of UFOs and related phenomena may be projections of these collective mentalities. Certain features of Michael Harner's encounter with the dragonlike beings certainly suggest that he was confronting a kind of visuai manifestation of the intelligence of the DNA molecule. In this same vein Strieber has suggested the possibility that UFO beings are what "the force of evolution looks like when it's applied to a conscious mind."[1]™ We must remain open to all of these possibilities. In a universe that is conscious right down to its very depths, animals, plants, even matter itself may all be participating in the creation of these phenomena.

One thing that we do know is that in a holographic universe, a universe in which separateness ceases to exist and the innermost processes of the psyche can spill over and become as much a part of the objective landscape as the flowers and the trees, reality itself becomes little more than a mass shared dream. In the higher dimensions of existence, these dreamlike aspects become even more apparent, and indeed numerous traditions have commented on this fact. The Tibetan Book of the Dead repeatedly stresses the dreamlike nature of the afterlife realm, and this is also, of course, why the Australian aborigines refer to it as the dreamtime. Once we accept this notion, that reality at all levels is omnijective and has the same ontological status as a dream, the question becomes, Whose dream is it?

Of the religious and mythological traditions that address this question, most give the same answer, It is the dream of a single divine intelligence, of God. The Hindu Vedas and yogic texts assert again and again that the universe is God's dream. In Christianity the sentiment is summed up in the oft repeated saying, we are all thoughts in the mind of God, or as the poet Keats put it, we are all part of God's "long immortal dream."

But are we being dreamed by a single divine intelligence, by God, or are we being dreamed by the collective consciousness of all things— by all the electrons, 2 particles, butterflies, neutron stars, sea cucumbers, human and nonhuman intelligences in the universe? Here again we collide headlong into the bars of our own conceptual limitations, for in a holographic universe this question is meaningless. We cannot ask if the part is creating the whole, or the whole is creating the part because *the part, is the whole.* So whether we call the collective consciousness of all things "God," or simply "the consciousness of all things," it doesn't change the situation. The universe is sustained by an act of such stupendous and ineffable creativity that it simply cannot be reduced to such terms. Again it is a self-reference cosmology. Or as the Kalahari Bushmen so eloquently put it, "The dream is dreaming itself."

9

Return to the Dreamtime

Only human beings have come to a point where they no longer know why they exist. They don't use their brains and they have forgotten the secret knowledge of therr bodies, their senses, or their dreams. They don't use the knowledge the spirit has put into every one of them; they are not even aware of this, and so they stumble along blindly on the rood to nowhere—a paved highway which they themselves bulldoze and make smooth so that they can get faster to the big empty hole which they'll find at the end, waiting to swallow them up. It's a quick comfortable superhighway, but I know where it leads to. I've seen it. I've been there in my vision and it makes me shudder to think about it.

—the Lakota shaman Lame Deer
Lame Deer Seeker of Visions

Where does the holographic model go from here? Before examining the possible answers, we might want to see where the question has been before. In this book I have referred to the holographic concept as a new theory, and this is true in the sense that it is the first time it has been presented in a scientific context. But as we have seen, several aspects of this theory have already been foreshadowed in various ancient traditions. They are not the only such foreshadowings, which is intriguing, for it suggests that others have also found reason

to view the universe as holographic, or at least to intuit its holographic qualities.

For example, Bohm's idea that the universe can be viewed as the compound of two basic orders, the implicate and the explicate, can be found in many other traditions. The Tibetan Buddhists call these two aspects the void and nonvoid. The nonvoid is the reality of visible objects. The void, like the implicate order, is the birthplace of all things in the universe, which pour out of it in a "boundless flux." However, only the void is real and all forms in the objective world are illusory, existing merely because of the unceasing flux between the two orders.[1]

In turn, the void is described as "subtle," "indivisible," and "free from distinguishing characteristics." Because it is seamless totality it eannot be described in words.[2] Properly speaking, even the nonvoid cannot be described in words because it, too, is a totality in which consciousness and matter and all other things are indissoluble and whole. Herein lies a paradox, for despite its illusory nature the nonvoid still contains "an infinitely vast complex of universes." And yet its indivisible aspects are always present. As the Tibet scholar John Blo-feld states, "In a universe thus composed, everything interpenetrates, and is interpenetrated by, everything else; as with the void, so with the non-void—the part *is* the whole."[8]

The Tibetans prefigured some of Pribram's thinking as well. According to Milarepa, an eleventh-century Tibetan yogin and the most renowned of the Tibetan Buddhist saints, the reason we are unable to perceive the void directly is because our unconscious mind (or, as Milarepa puts it, our "inner consciousness") is far too "conditioned" in its perceptions. This conditioning not only keeps us from seeing what he calls "the border between mind and matter," or what we would call the frequency domain, but also causes us to form a body for ourselves when we are in the between-life state and no longer have a body. "In the invisible realm of the heavens ... the illusory mind is the great culprit," writes Milarepa, who counseled his disciples to practice "perfect seeing and contemplation" in order to realize this "Ultimate Reality."[4]

Zen Buddhists also recognize the ultimate indivisibility of reality, and indeed the main objective of Zen is to learn how to perceive this wholeness. In their book *Games Zen Masters Play,* and in words that could have been lifted right from one of Bohm's papers, Robert Sohl and Audrey Carr state, "To confuse the indivisible nature of reality

with the conceptual pigeonholes of language is the basic ignorance from which Zen seeks to free us. The ultimate answers to existence are not to be found in intellectual concepts and philosophies, however sophisticated, but rather in a level of direct nonconceptual experience [of reality]."[5]

The Hindus call the implicate level of reality Brahman.[6] Brahman is formless but is the birthplace of all forms in visible reality, which appear out of it and then enfold back into it in endless flux.[7] Like Bohm, who says that the implicate order can just as easily be called spirit, the Hindus sometimes personify this level of reality and say-that it is composed of pure consciousness. Thus, consciousness is not only a subtler form of matter, but it is more fundamental than matter; and in the Hindu cosmogony it is matter that has emerged from consciousness, and not the other way around. Or as the Vedas put it, the physical world is brought into being through both the "veiling" and "projecting" powers of consciousness."

Because the material universe is only a second-generation reality, a creation of veiled consciousness, the Hindus say that it is transitory and unreal, or *maya.* As the Svetasvatara Upanishad states, "One should know that Nature is illusion *(maya),* and that Brahman is the illusion maker. This whole world is pervaded with beings that are parts of him."[9] Similarly, the Kena Upanishad says that Brahman is an uncanny something "which changes its form every moment from human shape to a blade of grass."[10]

Because everything unfolds out of the irreducible totality of Brahman, the world is also a seamless whole, say the Hindus, and it is again *maya* that keeps us from realizing there is ultimately no such thing as separateness. *"Maya* severs the united consciousness so that the object is seen as other than the self and then as split up into the multitudinous objects in the universe," says the Vedic scholar Sir John Woodroffe. "And there is such objectivity as long as [humanity's] consciousness is veiled or contracted. But in the ultimate basis of experience the divergence has gone, for in it lie, in undifferentiated mass, experiencer, experience, and the experienced."[11]

This same concept can be found in Judaic thought. According to Kabbalistic tradition "the entire creation is an iilusory projection of the transcendental aspects of God," says Leo Schaya, a Swiss expert on the Kabbalah. However, despite its illusory nature, it is not complete nothingness, "for every reflection of reality, even remote, broken up and transient, necessarily possesses something of its cause."[12] The

idea that the creation set into motion by the God of Genesis is an illusion is reflected even in the Hebrew language, for as the Zohar, a thirteenth-century Kabbalistic commentary on the Torah and the most famous of the esoteric Judaic texts, notes, the verb *baro,* "to create," implies the idea of "creating an illusion."[13]

There are many holographic concepts in shamanistic thinking as well. The Hawaiian kahunas say that everything in the universe is infinitely interconnected and that this interconnectivity can almost be thought of as a web. The shaman, recognizing the interconnectedness of all things, sees himself at the center of this web and thus capable of affecting every other part of the universe (it is interesting to note that the concept of *maya* is also frequently likened to a web in Hindu thought).[1-1]

Like Bohm, who says that consciousness always has its source in the implicate, the aborigines believe that the true source of the mind is in the transcendent reality of the dreamtime. Normal people do not realize this and believe that their consciousness is in their bodies. However, shamans know this is not true, and that is why they are able to make contact with the subtler levels of reality.[15]

The Dogon people of the Sudan also believe that the physical world is the product of a deeper and more fundamental level of reality and is perpetually flowing out of and then streaming back into this more primary aspect of existence. As one Dogon elder described it, "To draw up and then return what one had drawn—that is the life of the world."[16]

In fact, the implicate/explicate idea can be found in virtually all shamanic traditions. States Douglas Sharon in his book *Wizard of the Four Winds: A Shaman's Story:* "Probably the central concept of shamanism, wherever in the world it is found, is the notion that underlying all the visible forms in the world, animate and inanimate, there exists a vital essence from which they emerge and by which they are nurtured. Ultimately everything returns to this ineffable, mysterious, impersonal unknown."[17]

The Candle and the Laser

Certainly one of the most fascinating properties of a piece of holographic film is the nonlocal way an image is distributed in its surface.

As we have seen, Bohm believes the universe itself is also organized in this manner and employs a thought experiment involving a fish and two television monitors to explain why he believes the universe is similarly nonlocal. Numerous ancient thinkers also appear to have recognized, or at least intuited, this aspect of reality. The twelfth-century Sufis summed it up by saying simply that "the macrocosm is the microcosm," a kind of earlier version of Blake's notion of seeing the world in a grain of sand.[18] The Greek philosophers Anaximenes of Miletus, Pythagoras, Heraclitus, and Plato; the ancient Gnostics; the pre-Christian Jewish philosopher Philo Jndaeus; and the medieval Jewish philosopher Maimonides—all embraced the macrocosm-microcosm idea.

After a shamanic vision of the subtler levels of reality the semimyth-ical ancient Egyptian prophet Hermes Trismegistus employed a slightly different phrasing and said that one of the main keys to knowl-edge was the understanding that "the without is like the within of things; the small is like the large."[13] The medieval alchemists, for whom Hermes Trismegistus became a kind of patron saint, distilled the sentiment into the motto "As above, so below." In talking about the same macrocosm-equals-microcosm idea the Hindu Visvasara Tan-tra uses somewhat cruder terms and states simply, "What is here is elsewhere."[20]

The Oglala Sioux medicine man Black Elk put an even more nonlocal twist on the same concept. While standing on Harney Peak in the Black Hills he witnessed a "great vision" during which he "saw more than I can tell and I understood more than I saw; for I was seeing in a sacred manner the shapes of all things in the spirit, and the shape of all shapes as they must live together as one being." One of the most profound understandings he came away with after this encounter with the ineffable was that Harney Peak was the center of the world. However, this distinction was not limited to Harney Peak, for as Black Elk put it, "Anywhere is the center of the world."[21] Over twenty-five centuries earlier the Greek philosopher Empedocles brushed up against the same sacred otherness and wrote that "God is a circle whose center is everywhere, and its circumference nowhere.',[22]

Not content with mere words, some ancient thinkers resorted to even more elaborate analogies in their attempt to communicate the holographic properties of reality. To this end the author of the Hindu Avatamsaka Sutra likened the universe to a legendary network of

pearls said to hang over the palace of the god Indra and "so arranged that if you look at one [pearl], you see all the others reflect in it" As the author of the Sutra explained, "In the same way, each object in the world is not merely itself, but involves every other object and, in fact, is everything else."[23]

Fa-Tsang, the seventh-century founder of the Hua-yen school of Buddhist thought, employed a remarkably similar analogy when trying to communicate the ultimate interconnectedness and interpenetra-tion of all things. Fa-Tsang, who held that the whole cosmos was implicit in each of its parts (and who also believed that every point in the cosmos was its center), likened the universe to a multidimensional network of jewels, each one reflecting all others ad infinitum.[24]

When the empress Wu announced that she did not understand what Fa-Tsang meant by this image and asked him for further clarification, Fa-Tsang suspended a candle in the middle of a room full of mirrors. This, he told the empress Wu, represented the relationship of the One to the many. Then he took a polished crystal and placed it in the center of the room so that it reflected everything around it. This, he said, showed the relationship of the many to the One. However, like Bohm, who stresses that the universe is not simply a hologram but a holo-movement, Fa-Tsang stressed that his model was static and did not reflect the dynamism and constant movement of the cosmic interrelat-edness among all things in the universe.[26]

In short, long before the invention of the hologram, numerous thinkers had already glimpsed the nonlocal organization of the universe and had arrived at their own unique ways to express this insight. It is worth noting that these attempts, crude as they may seem to those of us who are more technologically sophisticated, may have been far more important than we realize. For instance, it appears that the seventeenth-century German mathematician and philosopher Leibniz was familiar with the Hua-yen school of Buddhist thought. Some have argued that this was why he proposed that the universe is constituted out of fundamental entities he called "monads," each of which contains a reflection of the whole universe. What is significant is that Leibniz also gave the world integral calculus, and it was integral calculus that enabled Dennis Gabor to invent the hologram.

The Future of the Holographic Idea

And so an ancient idea, an idea that seems to find at least some expression in virtually all of the world's philosophical and metaphysical traditions, comes full circle. But if these ancient understandings can lead to the invention of the hologram, and the invention of the hologram can lead to Bohm and Pribram's formulation of the holographic model, to what new advances and discoveries might the holographic model lead? Already there are more possibilities on the horizon.

HOLOPHONIC SOUND

Drawing on Pribram's holographic model of the brain, Argentinian physiologist Hugo Zuccarelli recently developed a new recording tech-nique that allows one to create what amounts to holograms made out of sound instead of light. Zuccarelli bases his technique on the curious fact that the human ears actually emit sound. Realizing that these naturally occurring sounds were the audio equivalent of the "reference laser" used to recreate a holographic image, he used them as the basis for a revolutionary new recording technique that reproduces sounds that are even more realistic and three-dimensional than those produced through the stereo process. He calls this new kind of sound "holophonic sound."[26]

After listening to one of Zuccarelli's holophonic recordings, a reporter for the *Times* of London wrote recently, "I stole a look at the reassuring numbers on my watch to make sure where I was. People approached from behind me where I knew there was only wall ___ By the end of seven minutes I was getting the impression of figures, the embodiment of the voices on the tape. It is a multidimensional 'picture' created by sound."[27]

Because Zuccarelli's technique is based on the brain's own holo-graphic way of processing sound, it appears to be as successful at fooling the ear as light holograms are at fooling the eyes. As a result, listeners often move their feet when they hear a recording of someone walking in front of them, and move their heads when they hear what sounds like a match being lit too near to their face (some reportedly-even smelt the match). Remarkably, because a holophonic recording has nothing to do with conventional stereophonic sound, it maintains

its eerie three-dimensionality even when one listens to it through only one side of a headphone. The holographic principles involved also appear to explain why people who are deaf in one ear can still locate the source of a sound without moving their heads.

A number of major recording artists, including Paul McCartney, Peter Gabriel, and Vangelis, have approached Zuccarelli about his process, but because of patent considerations he has not yet disclosed the information necessary for a full understanding of his technique.*

UNSOLVED PUZZLES IN CHEMISTRY

Chemist Ilya Prigogine recently noted that Bohm's idea of the impli-cate-explicate order may help explain certain anomalous phenomena in chemistry. Science has long believed that one of the most absolute rules in the universe is that things always tend toward a greater state of disorder. If you drop a stereo off of the Empire State Building, when it crashes into the sidewalk it doesn't become more ordered and turn into a VCR. It becomes more disordered and turns into a pile of splintered parts.

Prigogine has discovered that this is not true for all things in the universe. He points out that, when mixed together, some chemicals develop into a more ordered arrangement, not a more disordered one. He calls these spontaneously appearing ordered systems "dissipative structures" and won a Nobel Prize for unraveling their mysteries. But how can a new and more complex system just suddenly pop into exis-tence? Put another way, where do dissipative structures come from? Prigogine and others have suggested that, far from materializing out of nowhere, they are an indication of a deeper level of order in the universe, evidence of the implicate aspects of reality becoming explicate.[28]

If this is true, it could have profound implications and, among other things, lead to a deeper understanding of how new levels of complex-ity—such as attitudes and new patterns of behavior—pop into existence in the human consciousness and even how that most intriguing complexity of all, life itself, appeared on the earth several billion years ago.

"A sample audio cassette of holophonically recorded sound can be obtained for fifteen dollars from interface Press, Box 42211, Los Angeles, California 90042.

NEW KINDS OF COMPUTERS

The holographic brain model has also recently been extended into the world of computers. In the past, computer scientists thought that the best way to build a better computer was simply to build a bigger computer. But in the last half decade or so, researchers have developed a new strategy, and instead of building single monolithic machines, some have started connecting scores of little computers together in "neural networks" that more closely resemble the biological structure of the human brain. Recently, Marcus S. Cohen, a computer scientist at New Mexico State University, pointed out that processors that rely on interfering waves of light passing through "multiplexed holographic gratings" might provide an even better analog of the brain's neural structure.[29] Similarly, physicist Dana Z. Anderson of the University of Colorado has recently shown how holographic gratings could be used to build an "optical memory" that exhibits associative recall.[30]

As exciting as these developments are, they are still just further refinements of the mechanistic approach to understanding the universe, advances that take place only within the material framework of reality. But as we have seen, the holographic idea's most extraordinary assertion is that the materiality of the universe may be an illusion, and physical reality may be only a small part of a vast and sentient nonphysical cosmos. If this is true, what implications does it have for the future? How do we begin to go about truly penetrating the mysteries of these subtler dimensions?

The Need for a Basic Restructuring of Science

Currently one of the best tools we have for exploring the unknown aspects of reality is science. And yet when it comes to explaining the psychic and spiritual dimensions of human existence, science in the main has repeatedly fallen short of the mark. Clearly, if science is to advance further in these areas, it needs to undergo a basic restructuring, but what specifically might such a restructuring entail?

Obviously the first and most necessary step is to accept the existence of psychic and spiritual phenomena. Willis Harman, the president of the Institute of Noetic Sciences and a former senior social

scientist at Stanford Research Institute International, feels this acceptance is crucial not only to science, but to the survival of human civilization. Moreover, Harman, who has written extensively on the need for a basic restructuring of science, is astonished that this acceptance has not yet taken place. "Why don't we assume that any class of experiences or phenomena that have been reported, through the ages and across cultures, has a face validity that cannot be denied?" he asks.[31]

As has been mentioned, at least part of the reason is the longstanding bias Western science has against such phenomena, but the issue is not quite so simple as this. Consider for example the past-life memories of people under hypnosis. Whether these are actual memories of previous lives or not has yet to be proved, but the fact remains, the human unconscious has a natural propensity for generating at least *apparent* memories of previous incarnations. In general, the orthodox psychiatric community ignores this fact Why?

At first glance the answer would appear to be because most psychiatrists just don't believe in such things, but this is not necessarily the case. Florida psychiatrist Brian L. Weiss, a graduate of the Yale School of Medicine and currently chairman of psychiatry at Mount Sinai Medical Center in Miami, says that since the publication of his best-selling book *Many Lives, Many Masters* in 1988—in which he discusses how he turned from being a skeptic to a believer in reincarnation after one of his patients started talking spontaneously about her past lives while under hypnosis—he has been deluged with letters and telephone calls from psychiatrists who say that they, too, are secret believers. "I think that is just the tip of the iceberg," says Weiss. "There are psychiatrists who write me they've been doing regression therapy for ten to twenty years, in the privacy of their office, and 'please don't tell anyone, but . ..' Many *are* receptive to it, but they won't admit it"[M]

Similarly, in a recent conversation with Whitton when I asked him if he felt reincarnation would ever become an accepted scientific fact, he replied, "I think it already is. My experience with scientists is that if they've read the literature, they believe in reincarnation. The evidence is just so compelling that intellectual assent is virtually natural."[33]

Weiss's and Whitton's opinions seem borne out by a recent survey on psychic phenomena. After being assured that their replies would remain anonymous, 58 percent of the 228 psychiatrists who responded

(many of them the heads of departments and the deans of medical schools) said that they believed "an understanding of psychic phenomena" was important to future graduates of psychiatry! Forty-four percent admitted believing that psychic factors were important in the healing process.[34]

So it appears that fear of ridicule may be as much if not more of a stumbling block as disbelief in getting the scientific establishment to begin to treat psychic research with the seriousness it deserves. We need more trailblazers like Weiss and Whitton (and the myriad other courageous researchers whose work has been discussed in this book) to go public with their private beliefs and discoveries. In brief, we need the parapsychological equivalent of a Rosa Parks.

Another feature that must be a part of the restructuring of science is a broadening of the definition of what constitutes scientific evidence. Psychic and spiritual phenomena have played a significant roie in human history and have helped shape some of the most fundamental aspects of our culture. But because they are not easy to rope io and scrutinize in a laboratory setting, science has tended to ignore them. Even worse, when they are studied, it is often the least important aspects of the phenomena that are isolated and catalogued. For instance, one of the few discoveries regarding OBFJs that is considered valid in a scientific sense is that the brain waves change when an OBEer exits the body. And yet, when one reads accounts like Monroe's, one realizes that if his experiences are real, they involve discoveries that could arguably have as much impact on human history as Columbus's discovery of the New World or the invention of the atomic bomb. Indeed, those who have watched a truly talented clairvoyant at work know immediately that they have witnessed something far more profound than is conveyed in the dry statistics of R. H. and Louisa Rhine.

This is not to say that the Rhines' work is not important. But when vast numbers of people start reporting the same experiences, their anecdotal accounts should also be viewed as important evidence. They should not be dismissed merely because they cannot be documented as rigorously as other and often less significant features of the same phenomenon can be documented. As Stevenson states, "I believe it is better to learn what is probable about important matters than to be certain about trivial ones."[35] It is worth noting that this rule of thumb is already applied to other

more accepted natural phenomena. The idea that the universe began in a single, primordial explosion, or Big Bang, is accepted without question by most scientists. And this is odd because, although there are compelling reasons to believe that this is true, no one has ever proved that it is true. On the other hand, if a near-death psychologist were to state flatly that the realm of light NDEers travel to during their experiences is an actual other level of reality, the psychologist would be attacked for making a statement that cannot be proved. And this is odd, for there are equally compelling reasons to believe this is true. In other words, science already accepts what is probable about very important matters *if* those matters fall into the category of "fashionable things to believe," but not if they fall into the category of "unfashionable things to believe." This double standard must be eliminated before science can begin to make significant inroads into the study of both psychic and spiritual phenomena.

Most crucial of all, science must replace its enamorment with objec-tivity—the idea that the best way to study nature is to be detached, analytical, and dispassionately objective—with a more participatory approach. The importance of this shift has been stressed by numerous researchers, including Harman. We have also seen evidence of its necessity repeatedly throughout this book. In a universe in which the consciousness of a physicist affects the reality of a subatomic particle, the attitude of a doctor affects whether or not a placebo works, the mind of an experimenter affects the way a machine operates, and the imaginal can spill over into physical reality, we can no longer pretend that we are separate from that which we are studying. In a holographic and omnijective universe, a universe in which all things are part of a seamless continuum, strict objectivity ceases to be possible.

This is especially true when studying psychic and spiritual phenomena and appears to be why some laboratories are able to achieve spectacular results when performing remote-vie wing experiments, and some fail miserably. Indeed, some researchers in the paranormal field have already shifted from a strictly objective approach to a more participatory approach. For example, Valerie Hunt discovered that her experimental results were affected by the presence of individuals who had been drinking alcohol and thus won't allow any such individuals in her lab while she is taking measurements. In this same vein, Russian parapsychologists Dubrov and Pushkin have found that they have more success duplicating the findings of other parapsychologists

if they hypnotize all of the test subjects present. It appears that hypnosis eliminates the interference caused by the conscious thoughts and beliefs of the test subjects, and helps produce "cleaner" results.[3]* Although such practices may seem odd in the extreme to us today, they may become standard operating procedures as science unravels further secrets of the holographic universe.

A shift from objectivity to participation will also most assuredly affect the role of the scientist As it becomes increasingly apparent that it is the *experience* of observing that is important, and not just the act of observation, it is logical to assume that scientists in turn will see themselves less and less as observers and more and more as experiences. As Harman states, "A willingness to be transformed is an essential characteristic of the participatory scientist."[37]

Again, there is evidence that a few such transformations are already taking place. For instance, instead of just observing what happened to the Conibo after they consumed the soul-vine *ayakuasca,* Harner imbibed the hallucinogen himself. It is obvious that not all anthropologists would be willing to take such a risk, hut it is also clear that by becoming a participant instead of just an observer, he was able to learn much more than he ever could have by just sitting on the sidelines and taking notes.

Harner's success suggests that instead of just interviewing NDEers, OBEers, and other journeyers into the subtler realms, participatory scientists of the future may devise methods of traveling there themselves. Already lucid-dream researchers are exploring and reporting back on their own lucid-dream experiences. Others may develop different and even more novel techniques for exploring the inner dimensions. For instance, although not a scientist in the strictest definition of the term, Monroe has developed recordings of special rhythmic sounds that he feels facilitate out-of-body experiences. He has also founded a research center called the Monroe Institute of Applied Sciences in the Blue Ridge Mountains and claims to have trained hundreds of individuals to make the same out-of-body journeys he has made. Are such developments harbingers of the future, fore-shadowings of a time when not only astronauts but "psychonauts" become the heroes we watch on the evening news?

An Evolutionary Thrust toward Higher Consciousness

Science may not be the only force that offers us passage to the land of nonwhere. In his book *Heading toward Omega* Ring points out that there is compelling evidence that NDEs are on the increase. As we have seen, in tribal cultures individuals who have NDEs are often so transformed that they become shamans. Modern NDEers become spiritually transformed as well, mutating from their pre-NDE personalities into more loving, compassionate, and even more psychic individuals. From this Ring concludes that perhaps what we are witnessing is "the *skamanizing of modern humanity.* '[138] But if this is so, why are NDEs increasing? Ring believes that the answer is as simple as it is profound; what we are witnessing is *"an evolutionary thrust toward higher consciousness for all humanity. "*

And NDEs may not be the only transformative phenomenon bubbling up from the collective human psyche. Grosso believes that the increase in Marian visions during the last century has evolutionary implications as well. Similarly, numerous researchers, including Raschke and Vallee, feel that the explosion of UFO sightings in the last several decades has evolutionary significance. Several investigators, including Ring, have pointed out that UFO encounters actually resemble shamanic initiations and may be further evidence of the shamanizing of modern humanity, Strieber agrees. "I think it's rather obvious that, whether [the UFO phenomenon is being] done by somebody or [is happening] naturally, what we're dealing with is an exponential leap from one species to another. I would suspect that what we're looking at is the process of evolution in action."[39]

If such speculations are true, what is the purpose of this evolutionary transformation? There appears to be two answers. Numerous ancient traditions speak of a time when the hologram of physical reality was much more plastic than it is now, much more like the amorphous and fluid reality of the afterlife dimension. For example, the Australian aborigines say that there was a time when the entire world was dreamtime. Edgar Cayce echoed this sentiment and asserted that the earth was "at first merely in the nature of thought-forms or visualization made by pushing themselves out of themselves in whatever manner desired. .. . Then came materiality as sueh into the earth, through Spirit pushing itself into matter."[40]

The aborigines assert that the day will come when the earth returns

to the dreamttme. In the spirit of pure speculation, one might wonder if, as we learn to manipulate the hologram of reality more and more, we will see the fulfillment of this prophecy. As we become more adept at tinkering with what Jahn and Dunne call the interface between consciousness and its environment, is it possible for us to experience a reality that is once again malleable? If this is true, we will need to learn much more than we presently know to manipulate such a plastic environment safely, and perhaps that is one purpose of the evolutionary processes that seem to be unfolding in our midst

Many ancient traditions also assert that humanity did not originate on the earth, and that our true home is with God, or at least in a nonphysical and more paradisiacal realm of pure spirit. For instance, there is a Hindu myth that human consciousness began as a ripple that decided to leave the ocean of "consciousness as such, timeless, spaceless, infinite and eternal."[41] Awakening to itself, it forgot that it was a part of this infinite ocean, and felt isolated and separated. Loye has argued that Adam and Eve's expulsion from the Garden of Eden may also be a version of this myth, an ancient memory of how human consciousness, somewhere in its unfathomable past, left its home in the implicate and forgot that it was a part of the cosmic wholeness of all things.[42] In this view the earth is a kind of playground "in which one is free to experience all the pleasures of the flesh provided one realizes that one is a holographic projection of a . . . higher-order spatial dimension."[43]

If this is true, the evolutionary fires that are beginning to flicker and dance through our collective psyche may be our wake-up call, the trumpet note informing us that our true home is elsewhere and we can return there if we wish. Strieber, for one, believes this is precisely why UFOs are here: "I think that they are probably midwifing our birth into the nonphysical world—which is their origin. My impression is that the physical world is only a small instant in a much larger context and that reality is primarily unfolding in a non-physical way. I don't think that physical reality is the original source of being. I think that being, as consciousness, probably predates the physical."[44]

Writer Terence McKenna, another longtime supporter of the holographic model, agrees:

> What this seems to be about is that from the time of the awareness of the existence of the soul until the resolution of the apocalyptic potential, there are roughly fifty thousand years. We are now, there can be no doubt, in the final historical seconds of that crisis—a crisis which involves the end of history, our departure from the planet, [and] the triumph over death. We are, in fact, closing distance with the most profound event a planetary ecology can encounter—the freeing of life from the dark chrysalis of matter.[4]"

Of course these are only speculations. But whether we are on the very brink of a transition, as Strieber and McKenna suggest, or whether that watershed is still some ways off in the future, it is apparent that we are following some track of spiritual evolution. Given the holographic nature of the universe, it is also apparent that at least something like the above two possibilities awaits us somewhere and somewhen.

And lest we be tempted to assume that freedom from the physical is the end of human evolution, there is evidence that the more plastic and imaginal realm of the hereafter is also a mere stepping stone. For example, Swedenborg said that beyond the heaven he visited was another heaven, one so brilliant and formless to his perceptions that it appeared only as "a streaming of light."[46] NDEers have also occasionally described these even more unfathomably tenuous realms. "There are many higher planes, and to get back to God, to reach the plane where His spirit resides, you have to drop your garment each time until your spirit is truly free," states one of Whitton's subjects. "The learning process never stops. . . . Sometimes we are allowed glimpses of the higher planes—each one is lighter and brighter than the one before."[47]

It may be frightening to some that reality seems to become increasingly frequency-like as one penetrates deeper into the implicate. And this is understandable. It is obvious that we are still like children who need the security of a coloring book, not yet ready to draw free-form and without lines to guide our clumsy hands. To be plunged into Swedenborg's realm of streaming light would be tantamount to plunging us into a completely fluid LSD hallucination. And we are not yet mature enough or in enough control of our emotions, attitudes, and beliefs to deal with the monsters our psyches would create for ourselves there.

But perhaps that is why we are learning how to deal with small doses of the omnijective here, in the form of the relatively limited confrontations with the imaginal that UFOs and other similar experiences provide.

And perhaps that is why the beings of light tell us again and again that the purpose of life is to learn.

We are indeed on a shaman's journey, mere children struggling to become technicians of the sacred. We are learning how to deal with the plasticity that is part and parcel of a universe in which mind and reality are a continuum, and in this journey one lesson stands out above all others. As long as the formlessness and breathtaking freedom of the beyond remain frightening to us, we will continue to dream a hologram for ourselves that is comfortably solid and well defined.

But we must always heed Bohm's warning that the conceptual pigeonholes we use to parse out the universe are of our own making. They do not exist "out there," for "out there" is only the indivisible totality. Brahman. And when we outgrow any given set of conceptual pigeonholes we must always be prepared to move on, to advance from soul-state to soul^tate, as Sri Aurobindo put it, and from illumination to illumination. For our purpose appears to be as simple as it is endless.

We are, as the aborigines say, just learning how to survive in infinity.

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